BEGINNERS' GUIDE TO FRUIT GROWING

F. A. WAUGH

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56

Beginners' Guide to Fruit Growing

A Simple Statement of the Elementary Practices of Propagation, Planting, Culture, Fertilization, Pruning, Spraying, etc.

By
F. A. WAUGH

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Amply Illustrated

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TO THE MEMORY OF
JUDGE FRED WELLHOUSE
"THE APPLE KING OF KANSAS"
ONE OF MY EARLIEST FRIENDS AND
ADVISORS IN THE FIELD OF
HORTICULTURE

PREFACE

THIS little book is written for the one who does not know. The man who has already arrived may think it hardly worth while, but I ask him to remember that the simplest questions are the ones oftenest asked, and that the beginners are the ones who oftenest need help. I trust no one will begrudge the excellent company of novices even so small a help as that which is here most humbly offered by their friend and well wisher,

F. A. WAUGH.

Massachusetts Agricultural College, 1912.

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I

PROPAGATION

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PRACTICALLY all fruit trees used in gardens or orchards are propagated* by grafting or by budding. This work is usually done by the nurseryman, who sells the trees at an age of one or two years. As a rule, subject only to rare exceptions, this is the best plan. The professional nurseryman, with his experience and with suitable soil, can grow better trees and grow them cheaper than can any ordinary farmer, gardener or fruit grower. Nevertheless there are a good many persons who

FIG. 1.—GRAFTING KNIFE

like to grow their own young trees, even at a slight extra expense, and such persons ought always to have the privilege. Every gardener and fruit grower, moreover, ought to understand the processes of budding and grafting, if only for fun or self-protection.

A few fruits, indeed, may be grown from cuttings, without grafting. These are mostly not tree fruits, but such things as currants, grapes, etc. A few varieties of pears and still fewer of plums are successfully grown from cuttings in the far southern

*See *The Propagation of Plants*, by A. S. Fuller. Orange Judd Co., New York.

states, but these cases hardly form a sufficient exception to prove the rule.

Among old orchards are a few also planted with seedling (ungrafted) trees. In early days there was some excuse—though rarely adequate excuse—for using these seedlings. Today there is no reason whatever for planting anything but grafted trees anywhere in America that a garden can be made or a farm opened up. When grafted or budded trees can be bought at 15 to 35 cents each, now the almost universal range of price, no man can afford to use seedlings.

ROOT-GRAFTING

One of the commonest ways of propagating nursery trees is by root-grafting. As this applies principally to the apple, it may be described as practiced with that fruit.

The apple stocks are grown from seeds saved from the cider mills. These seeds come largely from the New England states, especially Vermont and New Hampshire. The stocks are largely grown in a few restricted localities. At one year old these seedlings are dug, graded and sold to the nurserymen, who use them both in budding and grafting. Considerable quantities of similar seedling stocks are now being imported annually from France. These are known simply as French stocks, but they are not essentially different from the American stocks.

The amateur who wishes to do a little budding or grafting for himself should imitate the average nurseryman in buying his stocks ready grown. Of course, anyone can sow apple seeds in his own garden and can grow apple stocks just as easily as

he can grow cabbage; but the men who are spending a lifetime in this highly specialized branch of horticulture can evidently do the thing to better advantage.

For root-grafting the roots should be secured in November or early December. The cions, chosen from reliable trees of the desired varieties, should be cut about the same time. In cool, moist storage these cions will keep for two or three months without damage. They should be clean, straight shoots of one-year-old wood only, firm and well matured.

FIG. 2
SPLICE-GRAFT

The cion may be united with the stock by any one of several methods of grafting. The two members may be simply slanted off—the stock at its upper end, the cion at its lower end—with a clean cut, and the two pieces spliced together and tied with soft cloth or grafting twine. (Figure 2.) This is what is known as a splice-graft.

The usual method, however, is the whip-graft, or tongue-graft, which is simply an improvement in splicing, whereby the two parts hold together more firmly and more quickly grow together when stored or planted. The graftsman takes the cion in his left hand and with a sharp knife cuts the slanting lower end, just as in splice-grafting. Then, reversing the cion, he cuts a thin tongue, as shown in the illustration (Figure 3). The important consideration here, is to cut, not split, the wood, leaving a strong stiff tongue, which will tightly grip the similar tongue on the stock. The stock is cut in precisely the same way.

Cion and stock should each have a length of 3 to 6 inches, 4 inches being customary. A fair seedling apple root will cut into two pieces, and a good one into three pieces, and each piece may be used as the stock on which to start a new apple tree. The graft is then known as a piece-root graft. Or the entire root of the apple seedling may be used in one piece, one seedling root to each apple tree propagated. This is what is known as the whole-root graft. Great advantages have sometimes been claimed, but never proved, for the whole-root graft.

FIG. 2a—WHIP-GRAFTING

The customary working method is to cut and prepare several cions, then to prepare several stocks, then to fit cions and stocks together, tying each graft firmly with soft twine. A particularly fancy job is done by dipping the joints in soft grafting wax. The grafts are now completed and should be tied up in small bundles, about 50 to each bundle, and packed in sawdust. The sawdust should be slightly moistened and the boxes containing the grafts should be stored in a cool cellar, preferably safe from severe freezing. If the grafts are correctly made and packed before Christmas, they will heal before planting time in the spring. Stock and cion will be found firmly grown together when the boxes are brought into the field in early April for planting.

At potato-planting time in the spring, or per-

haps a week earlier, the grafts should be set in a clean, thoroughly tilled garden spot. Mellow, warm, well-drained soil with an abundance of plant food is essential. The garden line is stretched across the plot, a trench is opened out 8 to 12 inches deep,

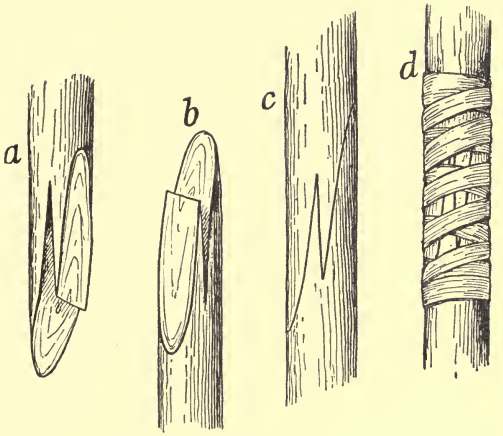

FIG. 3—WHIP-GRAFT

and the grafts set against the straight side of this furrow. They should be set 8 inches apart, and covered with soil nearly to the tops of the cions, leaving, say, two buds projecting. The soil should be firmly packed around them. Thereafter they are to be hoed and tended like any other crop. Such grafts are usually ready for transplanting to the orchard after two years' growth; but fertile soil and good care will give trees heavy enough for use in one year.

SIDE-GRAFTING

Another good method sometimes employed, especially with plums, is side-grafting. There are some variations of this method, but the one herewith described is as good as any—perhaps the best.

The stocks are not dug, but are grafted in the rows where they are grown. This item is especially applicable to plum grafting, for one can nearly always grow his own plum stocks as well as to buy

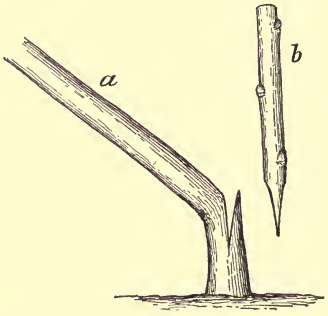

FIG. 4—SIDE-GRAFT

them. The work may be done in the autumn or very early in the spring. Cions are secured and kept just as for whip-grafting. When the graft is to be made, however, the cion is cut to a long, thin wedge at its lower end. The stock is cut with a slanting stroke downward, as near the surface of the ground as practicable, the left hand of the graftsman grasping the stem of the young seedling tree and bending it slightly away from the cut. The wedged end of the cion is then inserted in this

slit, then the seedling, being released, springs back into position securely pinching and holding the cion. For greater security the graft may be wound with soft cloth or grafting twine.

The cions on these grafts should begin to make strong growth by the middle or last of May. As soon as this stage is reached the seedling stocks should be cut off with a pair of strong shears just above the point of union. At the same time it will be well to cut any bandages or ties which were put on when the grafts were set.

FIG. 5—THE NURSE-GRAFT

THE NURSE-GRAFT

Of the hundreds of methods of grafting one other may be mentioned, more as a sample of such methods than for general recommendation. Nevertheless, the nurse-graft is a practical working method, and as good as any. In some cases it may have practical advantages. The method consists essentially in supplying a cutting with a root which acts as nurse. The form of making cut and union is exactly the reverse of that just described in side-grafting. The cion, which should be relatively long, say 12 inches, is given an upward cut near its middle, as shown in Figure 5. The piece of root which forms the stock or nurse is cut to a long wedge at its upper end. This wedge is in-

serted in the incision in the cion. The graft may then be tied with grafting twine, but in many cases this extra care will be found unnecessary. This method has sometimes been rather imaginatively called the "foster-mother graft." It is useful especially for those varieties which root readily from the cions. At the end of the first year's growth, then, the little stock may be removed, leaving an own-rooted tree, free from all foreign influences of a strange stock. In some cases this is considered advantageous.

BUDDING

Budding accomplishes the same ends as whip-grafting, but in a very different manner. It has advantages and disadvantages. As a rule it is practiced with the stone fruits generally, the reason being that the wood of these fruits is so soft and brittle that it cannot be cut in the forms required for grafting. Budding is also used largely on apple and pear trees. Some nurserymen prefer budding; others think grafting serves them better. The nurserymen of the eastern states usually propagate apples by budding; those of the central-western states mostly prefer the method of root-grafting.

Just here we may answer a common question as to the comparative value of the results. Sometimes a nurseryman will claim great advantages for his trees because they are budded rather than grafted; at other times men will claim the precedence for grafted trees; frequently special claims are put forth for trees propagated by some special method—perhaps some mysterious secret method. It is proper to treat all such claims either as pure bosh

or deliberate fraud. The fact is, that good clean nursery trees of the same size, weight and development are all worth precisely the same without reference to the methods whereby they were propagated. The particular method of budding or grafting is not worth a picayune to the thousand.

As budding is more extensively practiced with the peach than with any other fruit, we may most easily describe the method used in that work. The modifications of method required in budding apples, pears or plums are mostly unimportant, and would occur to any novice who might try to make the application for himself.

FIG. 6
BUDDING STICK

The stocks are grown in place, in the rows where they are to be budded. The peach pits are planted in these rows in early spring, and by the time they are required in the last half of August, the young seedlings should have a height of 3 to 4 feet, and a diameter at the ground of ½ to ¾ inches.

Budding time runs from the first of August to the first of October, depending partly on the growth, but chiefly on the condition of the stocks as determined by the conditions of weather. The regular test is made by observing whether the bark slips. The bark on the stock should peel or slip easily, just as it must on willow shoots when willow whistles have to be made. The stocks are then put in readiness by mild pruning, the lower branches, to a height of a foot, from the ground, being rubbed or cut off. This must not be done, however, till the hour when the buds are to be set.

The cions are cut as "budding sticks" from reliable fruiting trees of the variety which is to be reproduced. A budding stick is a shoot of the current year's growth, usually 12 to 18 inches in length, and having at the base the diameter of a small lead pencil. From this the blades of the leaves are

FIG. 7—POCKET BUDDING KNIFE

clipped immediately when the stick is taken from the parent tree. The petioles or stems of the leaves are left, however, and serve a very useful purpose in setting the buds. (See Figure 6.)

The operator should be supplied with a regular budding knife (Figure 7 or 8). Kneeling beside the row of stocks, he begins by cutting a T-shaped incision through the bark of the stock, preferably on the shady north side, and as near the surface of the

FIG. 8—RIGID BUDDING KNIFE

ground as he can conveniently work. The two lips of this incision should peel up smoothly from the wood beneath, so as to allow the easy insertion of the bud. The cion consists of a single bud cut shield-shape, as shown in Figure 9. This little shield is slipped downward in the opening made by the peeled-up bark on the stock, and is then tied in place with a soft strip of raffia. The tying is usually done by a boy or other laborer whose time is cheaper than that of a good budder.

These ties must be examined from time to time, and should be removed as soon as the buds "take." Within about a month, if not removed, they will begin to choke the stocks which continue to expand in diameter rapidly at this season. The tie is cut by running a sharp knife longitudinally up the stem of the stock on the side opposite the bud.

The buds should grow fast to the stocks within two to four weeks, but should remain dormant through the first winter. They should start into growth the following spring. As soon as their growth is assured the stocks should be smoothly cut off about an inch above the growing bud. Care is required throughout the first year to protect the nursling bud from the encroachments of the stock. Very often other buds start into growth from the stock and would soon smother the strange bud so carefully grafted in. Of course, all such seedling shoots must be promptly rubbed off.

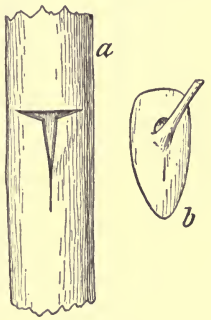

FIG. 9—SHIELD BUDDING

Budded peach trees should always be transplanted to their permanent positions in garden or orchard after the buds have grown one year. Strong growing varieties of plums and cherries should also be transplanted at one year old. Budded apples on good soil are best transplanted at one year from the bud, though the commoner practice is to grow them in the nursery rows to the age of two years. Like-

wise pears are usually grown two years in the nursery, but strong-growing varieties, like Kieffer, on good land will reach such a size the first season as to make transplanting advisable.

CLEFT-GRAFTING

While budding and whip-grafting are usually used in the propagation of trees in the nursery, cleft-grafting has its common application in the reworking of old trees in the orchard. If old pear trees, apple trees, or plum trees are bearing unknown or undesirable varieties of fruit they may be changed by grafting to any other variety desired. This is sometimes called top-grafting, as the work is done in the tops of the trees instead of on the roots.

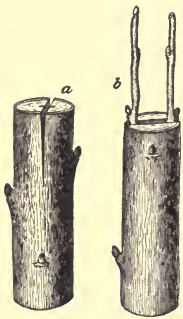

FIG. 10—CLEFT-GRAFTING

This top-grafting is done in early spring, the earlier the better. The last half of March offers the best opportunity, and the work runs grave danger of failure if delayed until the buds start on the trees. Cions for top-grafting are cut late in the fall before heavy freezing. They should be securely labeled with the names of varieties and stored in a cool dark cellar. When grafting time arrives preparations begin by making up a batch of grafting wax. Every true and tried graftsman has his own pet formula for this mixture, but the following recipes will serve as a basis for the work of beginners:

GRAFTING WAX

Resin	4 pounds
Beeswax	1 pound
Tallow	1 pound

Melt these together and pour the material into a pail of cold water. Then with greased hands pull the wax like old-fashioned taffy until it is white and comparatively clear. Slightly more beeswax in this formula will usually make a smoother working wax.

RECIPE NO. 2

Resin	6 pounds
Beeswax	1 pound
Pure linseed oil	1 pint

Cook thoroughly. This makes a softer wax, which can be applied with a stiff paint brush. The harder wax, about the consistency of chewing gum, is preferred by most workmen, and is applied with the bare hands.

Preparation next looks to the grafting tools, which are as follows: A small sharp saw, a light wooden mallet, a sharp knife and a special grafting knife.

Trees for top-grafting may be of almost any age, from two years old to two hundred. The work is most commonly done, however, on full-grown trees of 10 to 50 years of age.

Several branches are selected for grafting. These should be sound branches, free from disease, symmetrically placed throughout the tree top, and having a diameter of 2 to 4 inches. From 4 to 12 such branches should be used in grafting a tree of moderate size. The branches are sawed off squarely,

as low down as practicable, care being given to leave all the stubs about an equal distance from the center of the tree.

The operator now takes his grafting knife (sometimes called also a grafting chisel) and his light

FIG. 11—GRAFT AFTER ONE YEAR'S GROWTH

wooden mallet, and splits a stub down the center. This split should extend from 4 to 6 inches down the branch. The chisel is withdrawn and its wedge-shaped portion is inserted in the center of the stub, so as to open the split about one-half inch.

Meanwhile the cions have been prepared by cutting them in lengths of 4 inches and trimming each one to a long, thin wedge at the bottom. This

wedge should also slope slightly sidewise so as to be a trifle thicker at one side than at the other. With a cion having a diameter of ¼ to ⅜ inch the wedge portion should measure 1¼ inches from heel to point.

In the opened stub the graftsman now inserts two of these cions, one at either side, the thicker edge of the cion to the outer edge of the stub, as shown in the picture (Figure 10). The wedge is now withdrawn from the center of the stub, which will spring shut, pinching and holding the two cions in place. The graft is now protected by a covering of grafting wax, special care being used to cover the exposed split in the stock and the two openings along either side of the stub where the cions are put in.

This completes the graft. A little attention during the summer will prevent the growing cions being choked or shaded to death by shoots which sometimes spring up from the stubs. Such grafts will be ready to begin bearing after a growth of two to six years, the time being rather variable according to the very diverse circumstances which arise.

It is usually necessary to go over a tree grafted in this way, repairing and completing the grafting the year after the first work is done. Indeed, many experienced men prefer to regraft a tree in two or even three annual instalments. After a year's growth of the grafts, it is proper to prune out by degrees the old branches representing the variety formerly borne by the tree. Thus the tree is changed from one variety to another rather gradually, the entire change covering a period of two to six years.

FIG. 12—REGRAFTED PLUM TREE

INFLUENCE OF STOCK ON CION

The main purpose of graftage is to reproduce a variety more accurately than it can be reproduced by seed. A Baldwin apple, or a Green Gage plum, for instance, will not come true from seed. When, however, a variety is reproduced by grafting from cions, the reproduction is sufficiently exact to an-

swer all purposes. A whole orchard of grafted Baldwin trees are practically alike, or a whole block of budded Green Gage plums.

However, this method of reproduction is not absolutely perfect, because the stock on which the cions are grafted sometimes exerts a perceptible influence on the tree. These influences, though comparatively slight, are sometimes of practical importance. They are so curious and interesting that they have always been given careful study by horticulturists, who, in fact, have many times overemphasized their practical importance. Without making this mistake of magnifying the influence of the stock upon the cion, let us look briefly at the subject to see what these influences are.

The most important one is dwarfing. A small, slow-growing stock will make the tree smaller than it would be on a vigorous, fast-growing stock. This is the method by which dwarf trees are propagated. The Paradise apple, for example, is a very slow-growing variety, and a Baldwin cion grafted upon it will make a comparatively dwarf tree.

The habit of growth is sometimes greatly modified by the stock. The influence of the stock sometimes makes the tree more spreading, sometimes more upright. These influences are usually slight and seldom of any practical importance.

The stock sometimes brings trees into earlier bearing or, conversely, delays the bearing period. Dwarf stocks generally make trees bear earlier. In this instance, the influence has some practical value.

The stock may also influence the period at which the fruit matures. Varieties grafted on roots or stems of early ripening sorts will commonly ripen at an earlier period under such influence. No prac-

tical use has ever been made of this. The keeping quality of fruit is influenced in the same way. If earlier maturity is forced through the influence of the stock, this will cause a shorter keeping season. On the other hand, if a stock tends to give a tree a later period of maturity, the fruit will keep longer.

The flavor is sometimes influenced by the stock. A variety grafted on a sweet apple tends to develop a sweetish flavor.

Color is also modified at times in the same way. As a rule, of course, color, like flavor, will be modified in the direction of the same quality in the parent stock. A striped apple grafted on the stock of a dark red apple will tend to become darker in color. These influences are sufficient in some cases to make an important difference in exhibition specimens, but otherwise are of no practical consequence.

We may conclude, then, as we began, that while these modifications due to the action of the stock are very interesting, they are usually negligible in practice, and in general fruit growing no practical advantage can be taken of them.

STOCKS FOR VARIOUS FRUITS

In the propagation of trees in the nursery, a primary problem is always to secure suitable stocks. In some cases they are grown in the garden of the man who does the budding or grafting, while in other cases it is better economy to buy them in the open market.

Apple stocks may be grown in any garden, by planting apple seeds. The apple seeds should be taken from cider pomace, washed out, dried, and kept until the following spring. They are then

planted like any other garden seeds, in good garden soil. The strongest of the seedlings may be ready for budding the first of August. As a rule, they will need to be grown two years before they are ready for budding. The large ones should be suitable for root-grafting at the end of the first year. The small ones may be transplanted and grown another year, when they also will be ready for budding or grafting.

It is generally cheaper and more satisfactory, however, to buy apple stocks ready grown. They are extensively cultivated, especially in the neighborhood of Topeka, Kan., where the soil is particularly suited to the production of long, clean, straight apple roots. Prices vary considerably in different years and for different grades. The extreme range is from $1 to $10 a thousand. Usually a few apple stocks can be bought at retail at considerably higher prices from any ordinary nurseryman. This would be the source of supply for most amateurs.

At present considerable quantities of so-called French stocks are also used in this country. These are very similar to the American stocks. Some nurserymen consider them stronger and more free from disease than the American stocks and are therefore willing to pay higher prices for them.

Dwarf apples are propagated on so-called Paradise and Doucin roots. These two varieties are grown mostly in France, and are propagated by cuttings or layers instead of by seeds. Their use in this country is extremely restricted and the amateur will find it difficult to secure Doucin or Paradise stocks for his experimental grafting. Some of the larger American nurseries, however, which do

a considerable import business, will usually be able to supply them.

Pear stocks are grown very much like apples. In the case of pears, however, the supply is almost wholly foreign, and a very large majority of the pear stocks used come from France. They are handled in the nursery almost precisely like apple stocks and are budded or root-grafted in the same way. In recent years, a small supply of pear stocks has been secured from our southern states by the propagation of the Chinese hybrid varieties, such as Kieffer and Garber, which will grow from cuttings in a favorable soil and climate.

Dwarf pears are propagated on quince roots, always by budding.

Quinces are budded on quince roots. These stocks practically all come from Angers, France. They can, of course, be grown from seed, in the same manner as apple stocks.

Peaches are nearly always budded on peach seedlings. The seed may be secured either from canning factories or from the professional collectors of "wild peach" seed. These wild or native peaches are found growing rather freely through the mountains of North Carolina, South Carolina, and Georgia, and are thought to produce a very superior grade of seedlings for budding. The peach seeds are secured in the fall and should be buried in a clean, well-drained soil for the winter. If they freeze and thaw a few times during the winter it is a distinct advantage, especially in breaking open the shells. As soon as the garden soil is dry in the spring, the seeds are sown in rows 3½ to 4 feet apart and 6 inches apart in the row. They should make a growth of 2 to 4 feet by the middle of

August, at which time they would be ready for budding. Peach stocks can never be transplanted without injuring them so seriously as to make them almost worthless for further use.

Peaches are also sometimes propagated on apricot seedlings, and may be budded on almost any species or variety of plum seedling. Dwarf peaches may be produced readily by this method of working on any convenient species of plum. The one commonly used is the French plum, *Prunus cerasifera;* a better dwarfing stock, however, will be found in the native American plum, *Prunus americana,* or the sand cherry, *Prunus besseyi.*

Plums may be budded on almost any kind of seedling plums. The one commonly used in the nursery is the French plum, *Prunus cerasifera.* In the western states, *Prunus americana* is more commonly used and has some advantages. For one thing, it is hardier. It also has a decided dwarfing effect, which is often an advantage. The sand cherry, *Prunus besseyi,* makes an excellent dwarfing stock for most plums.

Plums are often worked on peach seedlings. Peach roots are particularly adapted to Japanese plums, more especially when the orchard is to be planted on warm, sandy soil.

Cherries are nearly always budded upon cherry stocks, and these stocks are extensively imported from Europe, especially from France. In some cases the seeds are imported and the stocks grown in this country. These stocks are of two sorts, the Mazzard and the Mahaleb. As a rule, the Mazzard stock is recommended as the better one, especially for the propagation of sweet cherries. The Mahaleb stock is said to be hardier and easier to work,

and somewhat better adapted to dwarf-growing sour cherries. On this account, it is frequently used.

BUYING NURSERY STOCK

When all has been said about the nursery propagation of stock, and while it is understood that such work is often intensely interesting to the amateur, and while it is admitted that it may sometimes be worth while, for special reasons, for the tree planter, still the large fact remains that nursery work can be done most economically and most successfully by the experienced nurseryman. The ordinary tree planter will find it is nearly always best, easiest and cheapest to buy his young trees of the man who makes propagation a profession. A few suggestions on the buying of nursery stock will really be of more practical value than any amount of instruction in the methods of propagating nursery trees.

First let us consider the question of locality. There is a common prejudice in favor of buying northern grown trees, the theory being that they are hardier. This theory has no foundation whatever in fact. If there is any preference as between northern and southern grown nursery fruit trees, then, within reasonable limits, this preference is all on the side of the southern product. The longer growing season in the South gives opportunity for the production of a larger, heavier tree; and this larger and heavier tree makes the better growth when it is set in the orchard row.

A similar prejudice exists in favor of buying locally grown trees, the argument advanced being that they are better adapted to the local climate and

will be more likely to succeed in the orchard. This argument is equally spurious. There is a certain advantage, however, in dealing with a local nurseryman; but this advantage lies in the shorter shipping distance, the possibility of sometimes visiting the nursery in person to select the stock, and in the slightly greater ease of doing business at short range.

In speaking of nurserymen here we have reference, of course, to those men who are legitimately in the business, and in the business to stay. The common itinerant fruit tree peddler often represents a doubtful nursery, more commonly no nursery at all, but rather a jobber who disposes of the culls turned over to him by men who have too tender a conscience to sell the stuff themselves. It should be preached everywhere as a part of the gospel of horticulture, that nobody should ever patronize the traveling fruit-tree agent on any account.

It used to be customary to classify fruit trees in the nursery as first grade, second grade, and third grade. While this classification is still used to some extent, it is inexact, difficult to use and generally unsatisfactory. A better way, and one now increasingly common, is to grade the trees according to their size. Either the height or the diameter at the soil or both these measures will be given. Thus a nurseryman will offer Elberta peach trees in the following grades: 6 feet and up, 5 to 6 feet, 4 to 5 feet, 3 to 4 feet, adding perhaps June buds 1½ to 2½ feet. In buying any of these trees, it is usually best to select the heaviest and largest, or perhaps as often to take the first grade below the extreme largest. The very light grades should be energetically avoided in any event. Where orders

of considerable size are pending, many good nurserymen are glad to send samples of the trees quoted, and this is a most excellent precaution on the part of the buyer.

It is customary, further, for the nurseryman to represent, and to some extent to guarantee, that the stock sold shall be clean, straight, well branched and free from all insects and fungous diseases. The freedom from insects and fungous diseases is usually further certified by an inspector's label supplied with each shipment. While the inspection back of this certificate may or may not have a salutary influence, it is an open question whether the label itself has any value whatever for the tree buyer.

It has been customary in times recently past to buy all apple trees from the nursery at two years old. Still earlier in the history of American horticulture 3-year-old, 4-year-old and more-year-old trees were frequently transplanted. The tendency has been constantly toward the use of younger trees, and this tendency has been so strong of late years that today 1-year-old apple trees are insisted on by the majority of the most expert fruit men. The writer owns to a very emphatic preference for the 1-year tree. It is much more plastic under the hands of the orchardist, more readily forms a symmetrical head, and shows a smaller percentage of loss in most plantings. Certainly no experienced tree man would today use apple trees over 2 years old.

The same tendency to the use of younger trees is visible in all other lines of fruit planting. Pear trees are still usually transplanted at two years of age, though Kieffer, Le Conte and Garber form distinct exceptions to this rule, being nearly always

set out at one year old. But even strong-growing varieties of the common European pear are now often sold from the nursery at the end of the first year's growth.

Peaches should never under any circumstances be bought from the nursery at a greater age than one year. On the other hand the so-called "June buds" of the nurserymen represent only a half-year's growth. While it may possibly be permissible to use these in case of a great emergency, it will be better to avoid them whenever the usual one-year trees can be had.

Plums vary so much in character that it is difficult to make any rule, except the general one in favor of young trees. Very slow-growing varieties may well be left for two years' growth in the nursery row, while vigorous-growing kinds are better transplanted at one year old. The Japanese varieties should always be planted out when one year old.

Even quinces do better if very strong one-year trees can be used. As the quince is slow growing by nature, it is hard to get trees heavy enough for nursery sales at one year except on the best of soil, and with the best of treatment. But such conditions are precisely those which favor the interest of the tree buyer, who should always prefer the heavy one-year-old quince trees when he can get them.

Something is said elsewhere about fall planting versus spring planting of orchards. For fall planting it is obligatory that the trees be selected and bought in midsummer or even earlier. But early buying is a very important matter in any case, and June or July is never too early to place orders for trees to be used the following spring. Such orders

may be delivered from the nursery in late fall, the trees being heeled in for the winter, or the trees may be stored in the nurseryman's storage house and delivered at planting time in the spring. Early deliveries are to be especially recommended whatever may be the planting plans.

II

PLANTING

THE proper distances for planting trees can be given with some definiteness, for though these distances are varied considerably by different planters, experience shows that close planting is disastrous to the orchard, while too wide planting is a great waste of space. The optimum distances as given in the following table should be pretty closely adhered to.

PLANTING DISTANCES

	Minimum	Optimum	Maximum
Standard apples on very strong soil	35	40	50
Standard apples on medium soil	33	35	40
Dwarf apples on Doucin stocks	12	16½	24
Dwarf apples on Paradise stocks	6	10	15
Standard pears	20	28	30
Dwarf pears	10	12	20
Quinces	6	12	15
Peaches	10	15	20
Plums	15	20	30
Apricots	20	25	30
Sweet cherries	25	30	35
Sour cherries	12	16½	25

When double planting is practiced as described below, apples should be set either 16½ x 16½ feet, to be thinned out to 33 feet, or 20 x 20 feet to be thinned out to 40 x 40 feet. When apples are interplanted with peaches or dwarf apples the same distances should be observed. Pears interplanted with dwarf pears, dwarf apples, sour cherries or plums, should be placed 25 x 25 feet, with the temporary trees between, making the original planting 12½ x 12½ feet. In such a plantation, however, every third longitudinal row of fillers will need to be removed at a comparatively early age so as to allow the passage of spraying machinery.

The following table shows the number of trees required to plant an acre when placed at various distances:

NUMBER OF TREES TO THE ACRE

6 x 6 feet,	1,210 trees
8 x 8 "	680 "
10 x 10 "	435 "
12 x 12 "	302 "
12½ x 12½ "	278 "
15 x 15 "	193 "
16 x 16 "	170 "
16½ x 16½ "	160 "
20 x 20 "	108 "
24 x 24 "	75 "
25 x 25 "	70 "
30 x 30 "	48 "
33 x 33 "	40 "
35 x 35 "	35 "
40 x 40 "	27 "
45 x 45 "	21 "
50 x 50 "	17 "

For setting out an interplanted orchard, say apples filled with peaches, trees 16½ feet apart, there will be required 40 apples and 120 peach trees to each acre. If the trees are to be set 20 x 20 feet the number of apple trees will be 27, and the number of peach trees as fillers will be 81.

In order to find the number of trees required to plant an acre at any other distances, multiply the distance between trees in one direction by the distance in the other direction and divide 43,560 by the product. For example, if it be desired to set a plantation with trees 12 x 32 feet, the required number would be computed thus:

$$43{,}560 \div (12 \times 32) = 113 \text{ trees to each acre}$$

DOUBLE PLANTING AND INTERPLANTING

When a new orchard is set out, say, with apple trees 40 feet apart, the ground is only partially occupied. In fact, the trees do not use more than one-fourth of the ground during the first 10 years of their growth; for another 10 or 15 years, they will be using one-half the land, more or less. On the other hand, if the trees are planted 16 or 20 feet apart, so as to economize space and use the soil to greater advantage during the early years of growth, they presently crowd one another and are greatly damaged by such close planting. These are very serious situations and practical orchardists have made considerable effort to meet the difficulty in various ways, usually by double planting or interplanting.

Double planting consists in putting out the trees at one-half the required permanent distance; thus, if it is desired to have the trees stand finally 40 feet

apart, the original planting is made with the trees 20 feet apart. When crowding first begins, alternate rows are removed lengthwise, in one direction. This gives relief for a considerable time. Later, another portion of the trees is removed, cutting crosswise of the field. Thus, in two or three suc-

FIG. 13—A WELL-PLANTED PLUM ORCHARD

cessive thinnings, the orchard is reduced from its original stand to one-fourth of the original number of trees.

The system of interplanting is the same as double planting, except that the temporary trees are of varieties different from the permanent trees. In the case of apple orchards, these may be simply earlier-bearing varieties, or they may be dwarf trees, or they may be peach trees, or almost any other kind.

Interplanting may, in fact, be reduced to three fairly distinct types. In the first type, there are

two varieties, as two sorts of apples, or two sorts of pears, both of one kind of fruit placed together. In practically all cases there will be one-fourth permanent trees and three-fourths temporary trees. The temporary trees should be smaller in habit of growth and earlier in habit of bearing.

In the second type of interplanting, two different species or kinds of fruit are used; usually permanent apple trees are interplanted with peach or plum, sometimes with pear, or cherry trees.

The third type consists of a still further filling of the orchard, in which three different types of fruit are used. Such a plantation consists of (1) permanent apple trees, (2) temporary fillers, such as pear or cherry, and (3) underplanted rows of bush fruits, such as currants or gooseberries. Such triple-planted plantations are not uncommon nor always unsuccessful. Strong soils, high feeding, and constant attention are required to get good results from such a complicated arrangement.

The advantages of these double-planting and interplanting methods are emphatic. Space is greatly economized, and as fruit land is often very high priced, this economy means a good deal in cash. Fertilizer is also economized to a greater or less extent. The expenses of cultivation, etc., are also proportionately reduced. Another advantage of considerable importance in many cases is that the interplanted trees and bush fruits come into bearing earlier than the permanent trees and put the plantation on a remunerative basis much sooner.

There are disadvantages, of course: thickly planted plantations are difficult to manage, difficult to cultivate, and especially difficult of access with spraying machinery. They require much more

careful attention; it is a great deal easier to succeed with one crop growing on a piece of land than with two or three different crops on the same land, especially when these different crops have somewhat different requirements. One of the great objections to the planting of apples and peaches on the same land is commonly said to be that they require different quantities and kinds of fertilizers. While this objection appears to be rather strained, the principle on which it is founded is correct. The chief practical objection in experience arises from the fact that many planters do not thin out the orchard soon enough; the trees are allowed to stand until they may seriously injure one another. This is a genuine danger, though it is not the fault of the system, but is due simply to its misapplication.

LAYING OUT THE LAND

When a piece of ground is nicely prepared and ready to plant (it should be left with a smooth clean surface, as a rough surface interferes seriously with the accuracy of the layout), it should be staked off, placing a stake at each point where a tree is to be planted. This should be done as accurately as possible. While it is doubtless true that trees will grow as well in crooked rows as in straight ones, yet the straight rows look a whole lot better and are actually somewhat easier to cultivate. Anyone who has sense and self-respect enough to plant fruit trees at all will certainly want to present the most orderly and attractive plantation possible. A surveyor's instrument and a chain will give the most satisfactory layout if reasonably manipulated. A simpler way, working without special tools. is

to lay one straight row along one side or down the middle of the tract, straightening it by careful sighting and spacing the trees accurately by repeated measurements. For making these measurements nothing is better than a light wooden pole carefully cut to the required length.

When the first long row is properly staked out a cross row should be established at right angles to it, and this cross row spaced and staked with the same care. From these two base lines the remainder of the field may be laid off rapidly and with very little trouble, unless indeed the ground is very rough and hilly.

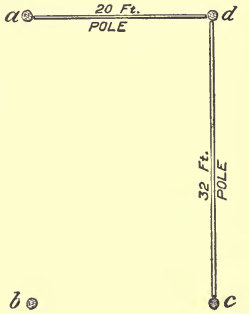

FIG. 14—HOW TO LAY OFF LAND

The best way to do this is to take two light poles cut to the length and the breadth of the tree spaces, say 20 feet each if the trees are to stand 20 x 20 feet, or 20 and 32 feet respectively if the trees are going in at 20 x 32 feet. Place these poles on the ground as shown in Figure 14 with one pole against the second tree in the base row and the other ended against the second tree in the cross row. Then bring the two free ends of the poles together, and where they meet at the point, d, is the place for the next tree. Set a stake here, move the poles forward, using this point, d, as a starting point for the next measurement, and proceed as before. After a row of stakes has been set in this way the layout should be gone over again, carefully sighted, and

the row perfectly straightened. If each successive row is carefully aligned in this manner the final result, except on very hilly ground, will be satisfactory.

PLANTING OUT THE TREES

The job next in order will be to dig the holes. These will ordinarily be 2 feet in diameter and 16 inches deep, these dimensions varying somewhat with the size of the trees and the character of the soil. The harder the soil the larger should the holes be. In order that the tree when it is planted may occupy exactly the point established for it in the setting of the peg it is necessary to have

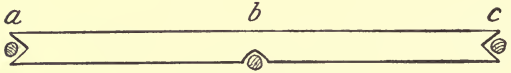

FIG. 15—TREE-PLANTING BOARD

recourse to the planting board or tree-jack. This simple device, which has been described and illustrated a thousand times, is shown once more in Figure 15. It consists of a light but strong board about 4 feet long and 4 inches wide, cut with a notch in either end and with a third notch in the exact middle.

To use this tree-jack it is laid on the ground with the middle notch snugly set upon the peg which marks the position of the prospective tree. Then two light stakes are driven in the two respective end notches, after which the jack may be taken to the next peg and the transaction repeated. After setting the two pegs for the ends of the planting board the hole may be dug, the center peg being taken up and thrown aside. Then when the holes

are all ready each tree may be placed precisely in its correct position by bringing back the planting board, replacing it on the two end pegs in its former position and holding the stem of the little tree firmly in the center notch while the roots are covered and trodden in. This simple method is now almost universally used.

FIG. 16—USE OF PLANTING BOARD

Each tree should be carefully pruned before planting. All broken roots and branches should first be removed. The roots may then be pruned enough to make them symmetrical. Any long and straggling roots should be cut off. As a rule tree planters are too much afraid to cut back the roots of nursery trees at planting time. The top of each

tree should be still more severely pruned. The least that should be done with any ordinary nursery tree is to cut back the top and all side branches so as to leave only stubs 1 to 3 inches in length. In planting one-year-old trees of most sorts it is still better to cut off absolutely all branches and further to cut back the main stem to about the point where the head is to be formed. Something more is said about this matter in the chapter on pruning, but it may be noticed here that the most experienced fruit growers of the present day shorten in their young trees in this manner very drastically at planting. Young apple trees are commonly headed back to straight sticks 18 inches high, peach, plum and pear trees to 12 inches or even to 6 inches. With healthy 1-year-old trees this practice gives the very best results.

Some further remarks on the selection of nursery stock will be found in Chapter I.

FALL VS. SPRING PLANTING

At this point attention should be given to the common query as to whether fall planting or spring planting is advisable. In the southern states planters often secure a convenient compromise of this question by doing their planting during the winter. In any latitude where there are frequent periods during the winter when the ground contains so little frost that planting may easily be done, the winter is almost the ideal planting time. In northern climates spring planting is the common practice, and perhaps the very best general rule is to set out the young trees at the earliest moment in the spring, remembering that the land must first

be thoroughly prepared. Late spring planting is not exactly dangerous, but it is more or less risky, and the later the planting is made the greater is the risk involved.

On the other hand fall planting has incontestable advantages. Work is not so rushing and labor can be managed much more effectively. Trees well planted in the fall make new roots to a greater or less extent and are ready for real business at the first call of spring. The best general statement that can be made of the case is to say that fall planting is desirable when all conditions are favorable—when good, mature trees can be had, when the soil is in first-class condition, and when a workmanlike job can be assured by the planters. Failing in any of these essential conditions, spring planting will be safer.

FIG. 17—THE ORCHARD IN BLOOM AFTER SPRING PLOWING

III

MANAGEMENT

THE management of an orchard or a fruit garden consists, of course, of all the processes necessary to keep the trees and plants in health, to keep them growing, and to make them fruitful. Certain of these processes, as pruning and spraying, involve so many unusual points that we have found it convenient to treat of them in separate chapters. In the present chapter we will discuss only cultivation, the use of cover crops, and fertilizers.

Orchard management is also sometimes made to include the harvesting, storing and marketing of the fruit; but these highly important operations really belong together and should be separated from the discussions of fruit growing. They may be grouped together preferably under the term "commercial pomology," which subject has already been treated in a book by itself.*

CULTIVATION

There has been a good deal of controversy in regard to the value of cultivation in orchards. It may be said, however, without reservation, that the great weight of authority and practice is on the side of cultivation and against all methods of non-cultivation. The practice of growing fruit trees in sod land without special care, a very common practice,

*Waugh's *Fruit Harvesting, Storing, Marketing.* Orange Judd Co., New York.

FIG. 18—CULTIVATION WITH SPRING-TOOTH HARROW

indeed, throughout the country, is wholly indefensible. It has not a respectable apologist in the field. Those who dissent from the accepted method of cultivation usually make a plea for what is known as the mulch method. This method deserves a brief examination, though not much more.

It is claimed that trees, apple trees especially, growing on rich soil of high water-holding capacity, may be handled more cheaply and easily by leaving them in sod than by keeping them cultivated. The land is sown down to blue grass, red top and clover in the ordinary manner. This grass is cut two or three times a year and is drawn about the roots of the fruit trees. In this respect the mulch method is radically different from the robbery method wherein the hay is carted to the barn. The mulch men, moreover, being fruit growers and not live stock growers, supply their trees with whatever additional fertilizer may be required; and in instances where the method is honestly and intelligently practiced, such men add more or less mulch to the land from other sources.

It is claimed that the mulch method is easier and cheaper than cultivation, that it may be used on hillsides so steep as to preclude cultivation, and that it produces fruit of higher color and better keeping quality than clean culture methods do. The objections to it are that it induces surface rooting of the trees, which is dangerous, that it keeps the soil in a poor physical condition, that it does not use the fertilizer to so good advantage, and especially that the grass robs the trees of large quantities of much-needed water.

As already stated, the best authorities in this country, both scientific and practical men, almost

unanimously favor the system of cultivation. The opinion in favor of cultivation is emphatic so far as peach and plum trees are concerned; it is less so with regard to apples; and even the most advanced exponents of culture will admit that pear trees sometimes need to be checked in growth by having the land sown down to grass.

The cultivation system is practiced about as follows: The land is plowed early every spring as soon as it is dry enough for cultivation. This plowing is fairly thorough, which does not mean, of course, a deep and careful turning of the soil as is accomplished in the growing of fine market garden crops. In fact, in many good soils this spring cultivation is given with the spading harrow rather than with the plow. The second cultivation will follow about two weeks later, and will be given either with the disk harrow or the spring-tooth harrow. If the land is in particularly good condition an even lighter implement may be used, perhaps the ordinary spike-tooth or smoothing harrow. Subsequent cultivations will follow at intervals of 10 days to two weeks until the day of sowing the cover crop. The purpose of these cultivations is to preserve the light dust mulch over the surface of the soil. This dust mulch is very useful in preventing the evaporation of moisture. These later cultivations can best be given with a light smoothing harrow.

The later cultivations in the orchard, being applied only to the surface and being accomplished with the lightest possible tools, may be given very rapidly. The harrow should be wide and light and should cover considerable space at each round of the team. It is possible to buy special orchard tools

for work under the trees. An adjustment which is often applied to disk harrows, spring-tooth harrows and smoothing harrows is a rigid middle section inserted so as to extend the two halves of the original implement out under the trees while allowing the horses to walk in the middle of the tree space. This is illustrated for the disk harrow in Figure 20. With such modern conveniences as these, it is possi-

FIG. 19—THE HORSE HOE FOR CLOSE CULTIVATION

ble to give thorough cultivation at low cost and at the same time to work closely under the branches of low-headed fruit trees.

THE COVER CROP

The term cover crop is applied to any annual crop sown between the trees and for their special benefit. It is usually sown after the regular period of cultivation, that is, between July 15 and August 1, though

sometimes later. It is allowed to stand on the ground until the following spring, when the entire crop is turned under for the benefit of the land at the time of the spring plowing. In this respect it is very different from truck crops, which are sometimes grown between the rows of young trees.

The cover crop is grown only in those orchards which are cultivated during the early part of the summer. The seed is usually broadcasted, though sometimes it is drilled in. The drilling method is particularly suited to soy beans and cowpeas.

Several distinct services are performed by the cover crop. The most important are as follows:

(1) The cover crop helps to check the growth of wood during the late summer. In this way it prevents the soft autumn growth which sometimes does not ripen well and is therefore injured by winter freezing. This autumn check upon wood growth comes chiefly from the tendency of the cover crop to take up from the soil a considerable portion of water which would otherwise go to the trees. Acting in this way, it may become an actual detriment to the trees, especially in seasons when a heavy crop of fruit is to be harvested late in the fall and after an insufficient rainfall. Under such circumstances it will be better to delay the sowing of the cover crop somewhat. In an emergency it might even be wise to cut the cover crop with a mower, to roll it down with a roller or to check its growth in some other manner.

(2) The cover crop often saves considerable amounts of fertilizer. Where soluble fertilizing elements are left in the soil they are always subject to loss during fall and spring through being carried down into the soil. They are dissolved by the rains

and drained away out of reach of the trees. When the cover crop is growing, these fertilizers are temporarily taken up by this cover-crop to be subsequently made again available when the cover crop decays in the soil. This service is particularly well rendered by such a crop as winter vetch, which grows nearly all winter.

(3) The cover crop saves erosion of the soil. Many orchard soils wash badly, especially in early spring. This difficulty is made one of the chief arguments against cultivating orchards. The dam-

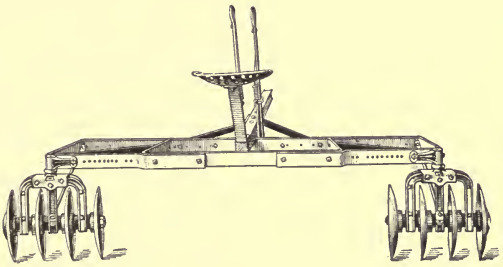

FIG. 20—EXTENSION DISK HARROW

age can be largely avoided by the use of some cover crop such as winter vetch, which grows at a very low temperature, and which holds its place throughout the winter.

(4) The cover crop adds humus or vegetable matter to the soil. This addition is extremely important. One of the most serious defects of the tillage system is that it tends to deplete this supply of vegetable matter. This tendency may be wholly corrected by the proper use of cover crops.

(5) The cover crop may add nitrogen to the soil. Such leguminous crops as peas, beans, cowpeas, soy beans, vetch, alfalfa, and clover collect nitrogen from the air. This nitrogen finally becomes available for the use of the trees when the cover crop is plowed under and rotted. Inasmuch as nitrogen is the most expensive of the fertilizing elements when bought in the market, this economy may prove to be of considerable financial weight.

The choice of a cover crop depends upon many local conditions. The leguminous crops will be given preference wherever possible on account of their ability to supply some nitrogen. There are many circumstances, however, which lead to the selection of other kinds of cover crops. It is useless to sow clover or alfalfa, for instance, on certain soils on which they will not succeed. It is necessary in order to get a good stand of clover or of alfalfa or of any other leguminous crop that the soil shall be sweet and that it shall be properly inoculated with the bacteria with which these particular crops are associated. In many cases it is worth while to supply the land with lime when cover crops are to be grown. In some cases an inoculation with bacteria will be found worth while. In a good many cases, however, the fruit grower will have recourse to other crops, especially buckwheat, which do not require such special preparations. Buckwheat is, in fact, one of the best of all cover crops in the northeastern states, and for several reasons. It may be successfully grown at a late period, seed can easily be had at a reasonable price, it makes a good stand and a heavy crop, it leaves the soil in excellent physical condition, and it adds a large amount of humus to the soil.

The cover crop should be plowed under as early in the spring as cultivation can be given in the orchard. This will be the deepest and most thorough plowing of the year. In fact, in most instances it will be the only time of the year when the plow

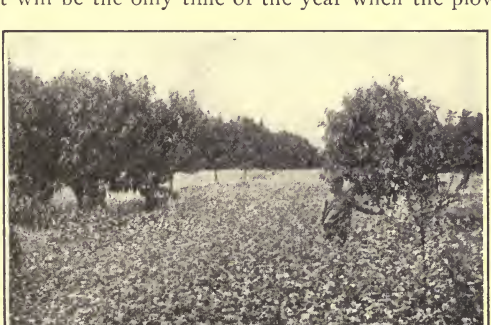

FIG. 21—COVER CROP OF BUCKWHEAT

will be used in the orchard. The following table will show the usual

QUANTITY OF SEED TO THE ACRE

Kind of Seed	Quantity	Cost
Mammoth clover, pounds	12	30–40c pound
Common red clover, pounds	12	25–35c pound
Crimson clover, pounds	15	20–30c pound
Alsike clover, pounds	12	25–30c pound
Alfalfa, pounds	20	25–30c pound
Cowpea, bushels	1½– 2	$3.00–$5.00 bushel

Kind of Seed	Quantity	Cost
Soy bean, bushels	1½– 2	$3.00–$5.00 bushel
Summer vetch, bushels	1½	$3.50–$4.00 bushel
Winter vetch, bushel	1	$6.00–$7.50 bushel
Canada pea, bushels	1½	$2.00–$3.00 bushel
Buckwheat, bushel	1	$1.50–$2.00 bushel
Rye, bushels	1½	$1.50–$2.00 bushel
Barley, bushels	1½– 2	$1.75–$2.50 bushel
Barley and peas, bushel, each	1	

THE USE OF FERTILIZERS

There has been a sort of blind assumption prevalent among farmers that fruit trees need little or no fertilizer. Such a misunderstanding might be explained if it were localized in the middle west, where fertilizers are not fashionable, but it is harder to see why this delusion should wax strongest in those very regions where the efficacy of fertilizers is generally unquestioned. The fact is that both science and experience argue that fruit plantations need regular and liberal feeding, the same as any other agricultural crop. If the exact requirements of fruit trees in this respect are not so well understood as are the requirements of tobacco, for example, it is because the subject is really a more difficult one.

Barnyard manure is the alpha and too often the omega of farm fertilizers, and is rather frequently applied to orchards. It is much better than none at all, and though not well adapted to this purpose, can be used to advantage in limited amounts. It contains an excess proportion of nitrogen, which gives it the effect of producing a rank and excessive growth of wood, often at the expense of fruit bear-

ing. Still the promotion of a more vigorous wood growth is precisely what is needed in many orchards, and in such cases barnyard manure might be the very thing to be prescribed. It has the great advantage, further, of bringing a considerable supply of humus or vegetable matter to the soil, and that is usually an important item. As a rule barnyard manure is not an economical fertilizer for fruit trees except when used in moderate quantities and in connection with mineral fertilizers bearing phosphoric acid and potash. It is better for apples and plums than for other fruits. It is of doubtful value for peaches, special cases aside; while on pears it is actually dangerous from the fact that the extra growth it induces is especially liable to attacks of the pear blight.

Lime, while not considered primarily as a fertilizer, is often very valuable in orchards. Many otherwise excellent fruit lands are "sour," that is, the soil has a surplus of acid. This extra acidity is highly detrimental to the growth of fruit trees, and should be corrected. The most important corrections are lime, cultivation and drainage. Lime may be used at the rate of one ton to the acre, sometimes more, or occasionally less.

Wood ashes are frequently recommended in glowing terms as peculiarly suited to the feeding of fruit trees. This suitability is more fancied than real. While they are excellent when properly used and reinforced with other fertilizers, they are generally omitted entirely from the orders of well-informed fruit men. The real reason for this is simply that the same quantity of good plant food may nearly always be bought in some other form at a much lower price. Wood ashes contain chiefly potash

and lime. The potash, however, which is the most valuable part, is exceedingly uncertain in quantity, so that most buyers feel safer when ordering potash in the form of muriate or sulphate. Where wood ashes are cheaply available they may be safely applied to fruit plantations at the rate of one to two tons to the acre.

The cheapest commercial source of nitrogen at present is nitrate of soda. This is especially useful for newly set trees, which it stimulates to a vigor-

FIG. 22—TRUCK CROPS (SQUASH) IN PEACH ORCHARD

ous and healthy growth. In such cases it should be used at the rate of one ounce to the tree at the time when growth starts. If more growth is wanted a similar application should be made about June first. Other sources of nitrogen are nitrate of potash, dried blood, tankage and fish scrap, all of which materials are suitable for use on fruit plantations.

It should be remembered that the office of nitrogen always is to promote wood growth and to some

extent to delay fruitage. It is needed, therefore, especially on young trees; but as old trees also must be kept in a state of healthy growth, nitrogen is always required. The nitrogen needs of the tree may be pretty accurately gauged by the color of the foliage. If the leaves are large, glossy and dark green the nitrogen supply is usually sufficient. When they look yellow, small and thin, it is safe to investigate both the nitrogen and the water supply, as the explanation of such symptoms lies usually in a deficiency of one of these.

Nitrogen is by far the most expensive element in fertilizers, and is, therefore, always to be economized in every way. One of the best ways of economizing nitrogen in orchard management lies in the growing of nitrogen-gathering cover crops. (See page 46.)

Potash is the fertilizing element next in importance, and is thought to be especially valuable in maturing the crop of fruit. A large percentage of potash enters into the composition of apple seeds, peach seeds, etc.

The two forms of potash most commonly bought in the market are the muriate and the sulphate. Muriate of potash is largely used and is considered to be one of the cheapest sources of supply. It has the defect of being sour and thus increasing the acidity of the soil. As this condition is especially objectionable to fruit trees, many orchardists have discarded the muriate entirely in favor of the sulphate. The commercial sulphate is of two kinds, high grade and low grade, the latter containing a certain amount of magnesia, which has somewhat the same effect in the soil as lime—that is, a sweetening effect. Kainit is a cheap potash fertilizer,

but on account of the relatively small amount of actual potash contained and of a tendency to acidity it is not now used by the best fruit men in this country.

Phosphoric acid, in connection with potash, is also very important in the growing of fruit. This element is usually bought either in ground bone or in so-called acid phosphate. While the latter form is somewhat cheaper, the former seems to be rather better adapted to the needs of fruit trees. Another fertilizer carrying phosphoric acid and now becoming favorably known for use on fruit trees is basic slag meal (Thomas phosphate powder). While this fertilizer has not been low enough in price in the recent past to encourage its use, it seems to give such decided good results, particularly on sour soils, that it is being used more and more from year to year.

FERTILIZERS FOR SPECIAL FRUITS

It is impossible to give exact recipes for the fertilization of particular fruits, though many people seem to expect such statements from the chemists. All that can be done is to offer general suggestions, and the following fertilizer formulas are to be considered in that light. These formulas are to be varied as experience may indicate or local circumstances may require. All figures are given as pounds to the acre, and it is generally understood that the fertilizers are to be put on after the first plowing in the spring and cultivated into the soil.

For bearing apple orchards Dr. W. P. Brooks recommends:*

*See Waugh's *American Apple Orchard*, p. 97. Orange Judd Co.

Basic slag meal, 400-500 pounds
Low-grade sulphate of potash, 300 pounds

In years when the orchard is bearing a good crop there should be added to this allowance 75 to 100 pounds of nitrate of soda.

Another formula, proposed by Geo. D. Leavens, fertilizer expert, is as follows:

Basic slag meal, 1,500 pounds
High-grade sulphate of potash, 300-500 pounds
Nitrate of soda, 200-400 pounds

This is a much more liberal treatment and is designed for an orchard in full bearing. It is especially understood further that the nitrate of soda must be used with great caution.

An old orchard, just being taken up from the sod and the sod turned under, needs to be handled with some care. The growth of new wood may have been very slight in previous years and yet the turning under and decay of the sod in the soil will result in furnishing nitrogen sufficient in all probability to force considerable new growth. Therefore, the application of nitrogenous fertilizers should be withheld in such cases. In other cases, where the new growth is needed and is not being made, from 100 to 150 pounds of nitrate of soda to the acre will generally furnish a sufficient amount of nitrogen. It is best to be conservative in the application of nitrate of soda to orchards. A first application of 100 pounds, followed by another supplementary application, if needed, is probably the wiser course. Mr. Leavens, who is responsible for these figures, suggests, also, that the orchard should receive the first year, if it has had little or no fertilization previous to this application, 800 to 1000 pounds of basic slag meal, and 300 to 400 pounds of high-grade

sulphate of potash. The amount of nitrogen to be applied will depend entirely upon the growth the trees are making. If the trees are making a good growth of new wood, all that can well be ripened, no nitrogenous fertilizer need be applied.

In subsequent years the application of phosphoric acid and potash may be reduced somewhat, and 600 to 800 pounds of basic slag meal and 150 to 300 pounds of high-grade sulphate of potash may be used to the acre, the amount of potash applied depending in a large measure on the character of the soil. Soils rich in clay furnish naturally more potash than sandy soils or those commonly known as loamy soils.

Young trees during the first two years after planting may be given the following amounts for each tree:

Nitrate of soda,	1 ounce
Basic slag meal,	10 ounces
Low-grade sulphate,	6 ounces

As the orchard grows these amounts must be gradually increased. And once more it must be emphasized that all such recipes are only suggestions and are to be constantly varied according to local and special conditions. In particular, the fruit grower should be ready to give additional applications of nitrate of soda (but not later than June 10) to such trees as are not making sufficient growth.

Young peach trees may receive the same rations suggested above for young apple trees, but usually it will be wise to give a second ounce of nitrate of soda to each tree a month after the first application. In some cases the young peach tree can use advantageously one-half pound of nitrate. This

amount will be not at all excessive during the second and subsequent summers.

When the peach tree comes into bearing it requires theoretically a little less phosphoric acid and a little more potash than does the apple, although where vigorous growth and sound wood are desired it is wise to use phosphoric acid liberally. Mr. George D. Leavens recommends from 500 to 800

FIG. 23—AN EXAMPLE OF GOOD TILLAGE

pounds to the acre each year of basic slag meal, and 200 to 400 pounds of high-grade sulphate of potash. If sufficient growth of new wood is not being made 100 pounds of nitrate of soda to the acre will generally prove sufficient. It is assumed that the growing of cover crops and plowing under, together with tillage until midsummer, will be followed as a matter of course.

In case the peach trees for any reason are badly impoverished from over-bearing due to neglect to

thin, or have suffered from extremes of weather, it is very frequently helpful to make a light application of nitrate of potash, provided this material is in the market at a price at which it can be obtained for fertilizing purposes. For such work the so-called crude saltpeter, imported from Calcutta, is the best. It generally tests about 94% pure and carries the equivalent of about 14% ammonia, and 44 to 45% of actual potash. Even so light an application of this material as one pound to every five or six trees frequently results in enormous benefit.

If we put this in the form of a general recipe, subject to the important qualifications already mentioned, we may say that the annual application required by an acre of bearing peach orchard would be:

Nitrate of soda,	50-100 pounds
Basic slag meal,	500-800 pounds
High-grade sulphate of potash,	200-400 pounds

In dealing with pears it is always to be remembered that special care is required in the use of nitrogen. This element must be given in relatively small quantities to avoid the production of a soft rapid growth of wood. As a somewhat rough estimate of average needs, we may propose the following formula for pears:

Basic slag meal,	500-800 pounds
High-grade sulphate of potash,	300-500 pounds

To this there may be added small quantities of nitrogenous fertilizers, such as dried blood, whenever the foliage shows yellow and the trees are clearly not making sufficient growth.

In dealing with plums we have several very different species of fruits, which should be separated into

at least two particular groups for purposes of practical management. The Japanese plums should be managed like peaches, while the European *(domestica)* varieties need a form of treatment more like pears. They will stand rather more nitrogen than pears, but the potash and phosphoric acid requirements are very much the same. This may be expressed roughly in the following formula:

Nitrate of soda,	50-100 pounds
Basic slag meal,	400-800 pounds
High-grade sulphate of potash,	300-500 pounds

No one knows enough of the peculiar needs of quinces to justify a special formula. Quinces may be treated generally after the manner of dwarf apples.

Apricots and nectarines should be treated the same as peaches.

IV

PRUNING

Fruit trees will grow and bear without pruning. Among fruit growers there is a considerable party working on a policy of no pruning. Nevertheless, the large majority of practical and scientific men recognize the necessity of pruning of some sort and for all kinds of fruit trees. The argument sometimes advanced that pruning is unnatural and, therefore, necessarily wrong, is particularly worthless. All methods of agriculture and horticulture are unnatural. All our work with plants is based on interference with nature's methods. Only the savage who gathers his fruits from wild trees and vines follows the scheme of nature unrestrained.

The methods used in pruning are very diverse and are too little understood. Here we find probably the weakest point in American fruit growing. While almost any kind of pruning will keep the trees alive and secure an occasional crop, there are very few men who have a true system of pruning which reaches definite results in the most direct and certain fashion.

PURPOSES OF PRUNING

Pruning is practiced upon fruit trees for a great many different purposes, the most important of which are as follows:

To shape the tree. Especially during the first years after planting, the tree requires constant care in order to train it to the best possible form.

To restrict the growth. But even old trees have to be regulated as to form. The growth must be restricted. Otherwise they grow out of reach. In

FIG. 24—PLUM TREE WELL FORMED

old neglected orchards one will always find trees so tall that they cannot be sprayed to advantage nor the fruit harvested economically. In modern close-planted orchards, also, it is important to restrict

the lateral spread of trees in order that the day of cutting out crowding trees may be delayed as long as possible.

To keep the heads open. Many varieties of trees form so much wood that their heads are closed to air and sunlight. Fruit is borne only on the tops and sides. Varieties with this tendency must be opened out with the pruning knife, so as to let in sun and air.

To encourage new growth. While pruning is applied to trees which grow too much, it may be used also to correct the opposite tendency. Old trees which, through general neglect, have ceased to make reasonable growth, may be helped by severe cutting back.

To regulate fruit bearing. Proper pruning will serve either to encourage trees toward earlier or heavier bearing, or, differently applied, will serve to check a tendency toward overbearing.

FUNDAMENTAL PRINCIPLES

These very diverse objects are not accomplished, of course, without recourse to equally diverse methods of pruning. Let us look, therefore, at some of the principles on which these various methods are founded.

First, we should notice that the tendency toward wood growth and the tendency toward fruit bearing are to some extent antagonistic. During youth the tree grows rapidly, but bears no fruit; but when old age comes on there may be heavy crops of fruit, while the tree makes very scant growth. Throughout the life of the tree, moreover, any treatment which checks wood growth influences the tree

toward fruiting, and any treatment which promotes the growth of wood is pretty sure to check the formation of fruit buds.

Next we must remember that pruning done during the dormant season is generally followed by a stronger growth upon the remaining parts of the

FIG. 25—GOOD LOW-HEADED APPLE

tree. On the other hand, if pruning is done when the tree is in full growth, as in June, the growth of the tree is correspondingly checked.

These considerations raise the question of summer pruning. Can pruning, then, be done in the summer as well as in winter and spring? As a matter of fact, for certain purposes it can be done much better. Summer pruning is a practice by no means sufficiently understood by American fruit growers, and still less sufficiently practiced. We may accept it as a fact that at least one-half the pruning of fruit trees now given in winter and early spring could much better be given in June. In shaping young trees summer pruning and pinching is much more effective than winter pruning; and in the management of old trees summer pruning has the great advantage that it is not so much followed by a troublesome growth of suckers. Summer pruning comes into play in inducing trees of five to ten years' growth to come earlier into bearing.

There are other practical advantages in summer pruning, such as the fact that small wounds then heal more readily; or that the operator has a better chance to judge the growth of the tree and to locate dead branches; or, finally, that the labor is more easily performed than during the winter season.

THE TIME TO PRUNE

The question of the best season for pruning has always had a lively argumentative interest among fruit men, but the annual debates on the matter have been more valuable as an intellectual entertainment than as a settlement of horticultural practices. The old saying, that "the time to prune is when the

saw is sharp," has a good deal of force, and means that the season of pruning is not of vital importance. Aside from the summer (June) pruning discussed above, most work of this sort is done in early spring, or, in regions further south, at any time during the winter when field work is practicable. There are some real reasons for doing this spring pruning as early as possible after heavy freezing weather is over. First of all, the rush of spring work is thereby avoided; second, the wounds heal more easily; and third, the wounds are not so apt to bleed.

FIG. 26—PROPERLY HEALING WOUND

Another favorite matter of argument is the method of cutting the stub. Some pruners claim that any large branch should be cut just outside the collar or raised ring of bark which surrounds the base. Others say that it should be cut back as closely as possible to the parent branch. This question is really of small import. The stub should be cut close, smooth and clean, but in case only of the renovation of old and neglected orchards, or repairing trees broken by accident, is the cutting of large limbs really excusable. An orchard properly pruned from the beginning will not require such drastic surgery.

PAINTING WOUNDS

When large limbs are cut away the wounds

should be painted over with some composition for their protection. Many different mixtures have been recommended, but in actual practice nothing is better than plain white lead paint. A small amount of paris green or other coloring matter may be added

FIG. 27—TWO-YEAR-OLD PEACH, BUSH FORM

to the white lead merely to give the wounds a more agreeable coloring. A considerable number of glaring white spots in a tree do not look well, but aside from the shock to the observer's esthetic sensibilities the white color does no harm.

PRUNING FOR PLANTING

Pruning begins with the first day of a tree's existence in the orchard. The trees as they come from the nursery should be pruned before they are planted. This preparation for planting is described in its proper place (page 35), but one of the steps now taken has a very important bearing on the future pruning and development of the tree. This refers to the height at which the head is to be formed.

Some orchard men prefer high-headed trees, and cases have been known in which this has been interpreted to mean apple trees with trunks 9 feet, bare up to the first branches. It may be said with the utmost certainty that practical orchard men everywhere in America nowadays prefer trees with much lower heads than those in vogue a few years ago. Peaches are almost headed down to the ground, the trees being formed as bushes, and without any free trunks. Plums and cherries also are often pruned in this bush form, and even apples are sometimes managed in the same manner. An apple tree with a clear trunk four feet high would now be called a high-headed tree, and 2½ to 3 feet would be nearer the average of modern good practice.

This low heading has many very substantial advantages. The low-headed trees are much stronger. As they are also less exposed to such damage, they suffer much less by breakage from winds, sleet and overbearing. The trees can probably be brought earlier into bearing; and though this point is by no means proved, it seems that this difference may be as much as three to five years in favor of the

low-headed tree. The lower tree, of course, can be pruned and sprayed more economically and more efficiently; and there is a similar advantage in harvesting the fruit.

The one objection everywhere made against low-headed trees is that the low heads are said to interfere with the cultivation. The best answer to

FIG. 28—LOW-HEADED PEACH

this objection is simply that it is not so. It is a most curious fact that the strongest exponents of thorough tillage in orchards are the very men who also urge low heading, while the men who practice high heading are the ones who make hay in their orchards.

With these ideas in mind the planter will head back his nursery trees at planting time to about the height where he wants the tops to form. Modern

good practice, as nearly as it can be stated, is shown in the following table:

HEIGHT FOR HEADING YOUNG TREES

Kind of Fruit	Inches		
	Minimum	Best	Maximum
Standard apple	10	18-24	48
Dwarf apple	3	8-14	24
Pear	10	18-24	48
Dwarf pear	4	10-16	36
Peach	3	8-12	36
Plum	3	8-12	36
Quince	3	8-12	24

FIG. 29—HIGH-HEADED PEACH

Clean vigorous one-year-old trees (which are best) should be headed to one clean straight stub. Two-year-old apple or pear trees should have the side branches cut to spurs of one to three inches.

SHAPING THE TREE

The tree now starts upon the critical period of its first year's growth. If the man or the woman having it in charge wishes to give the very best possi-

FIG. 30—JAPANESE PLUM READY TO PRUNE

ble care there will be a good deal of very light but genuinely useful pruning to be done during May, June and July of this initial year. Such

pruning can mostly be done with thumb and finger. The work consists chiefly in removing shoots which start at undesirable points. Attention at this time will enable the operator to form a symmetrical

FIG. 31—JAPANESE PLUM PRUNED

and nicely balanced head better than at any subsequent period.

Whether this baby pruning is given or not, the young trees should be gone over carefully with sharp hand shears early the following spring. At

this time the young head is shaped, and if the summer pruning has been omitted, this spring shaping is of exceptional seriousness. Useless branches are cut away and then four or five strong branches are chosen to be the framework of the future tree. These should be as evenly balanced as possible. Instead of all coming out at the same height from the ground, they should start from different levels, as far as possible.

The extent to which these main branches are now to be cut back is a grave question. Practice varies considerably. But even the radical men who believe in a policy of no pruning for bearing trees generally believe that it is best to shorten this first year's growth severely at the first spring pruning. As nearly as this can be stated in a general rule we may say that it is best to cut off one-half to two-thirds the previous year's growth, leaving stubs 6 to 14 inches long.

From these a large number of secondary shoots will promptly appear, of which we shall eventually wish to preserve two or three to each stub. If we can afford to give the time and attention once more during June and July, the summer will be the best season for managing this part of the tree's development. Otherwise the tree will need another smoothing up with the hand shears early the second spring.

GENERAL METHODS

Here a division of practice begins to appear very clearly on the pomological horizon. One party believes in letting the trees pretty much alone, except for such thinning out, removal of interfering branches, and other minor corrections as are ob-

viously required. The heading back of the year-old shoots which are to remain is especially omitted. Hereafter the tree is allowed to grow without heading back. The other party believes in annual heading back with a view to forming more compact heads and with the idea that the formation of the heads can be more strictly controlled. It is only fair to say that in the present state of our pomological knowledge a positive decision cannot be given in favor of either method. Some men succeed by one method, others by the other.

FIG. 32—QUINCE READY TO PRUNE

During the succeeding early years of growth in the orchard this procedure continues. The heads will be kept open and clean under any method of management, while the men who believe in heading back their trees will continue their annual heading in, and the men who believe in allowing free and unrestricted growth will omit that portion of the annual pruning exercise.

When the trees come into bearing the treatment necessarily changes to some extent. The problems of forming the head of the tree have now been largely passed by and the leading problem now is the reproduction of an abundance of healthy fruiting wood. The men who have practiced the heading-in system should now, to be consistent, remove a certain portion of the top of each tree every year,

cutting out wood wherever it can best be spared, so as to permit the growth of an equal quantity of virgin wood. The men whose trees have been left largely to their own devices during their formative years will naturally continue to let the trees have their own way. And, so far as anyone can prophesy, both men will reap reasonable harvests of fruit. Both sets of men will practice enough pruning to cut out dead and diseased and broken branches or those which are rubbing or interfering with one another. This kind of pruning is chiefly an exercise of good practical horse sense. In so far as it is a scientific problem, involving the application of principles of plant physiology, nobody knows enough about it to give anyone else any directions. It is greatly to be hoped that the time may soon come when we shall have a logical and scientifically founded system of pruning adapted to American requirements; but we may as well confess that for the present our knowledge of these matters is lamentably crude and inadequate.

FIG. 33—QUINCE PRUNED

PRUNING TOOLS

The principal tools used in pruning are the following:

The hand. Many young shoots can be pinched

out by thumb and fingers; or when heavier growths are to be removed, as in summer pruning of peach trees or Japanese plums, the operator can, by pro-

FIG. 34—HAND SHEARS

tecting himself with a pair of stout canvas gloves, break out the soft shoots very rapidly and yet do an excellent sort of work. It hardly needs to

FIG. 35—TWO-HAND SHEARS

be remarked that this kind of pruning is the fastest and by far the cheapest sort that can be done.

The shears. The hand pruning shears are, all things

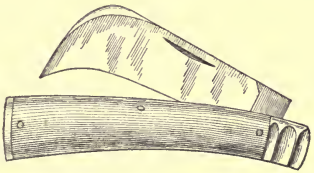

FIG. 36—POCKET PRUNING KNIFE

considered, the most useful of all pruning tools. (See Figure 34.) Shears of medium weight are best for general purposes, though if the fruit grower

feels like supplying himself with a full equipment, a set of shears—one pair light, one medium, and one heavy—will enable him to adapt his tool to the character of his work. This is a manifest advantage. The cheapest grades of shears should be avoided.

The two-hand shears (Figure 35) will be found suitable for rather heavy pruning. While they are not quite indispensable, they are well worth having.

FIG. 37—RIGID PRUNING KNIFE

The long-handled, or pole pruner is also a very valuable tool. This instrument may be had with poles of various lengths, from 6 to 12 feet.

The knife. Every nurseryman and orchardist is expected to carry a pruning knife with the typical curved blade (Figure 36), just to show his membership in the order. Sometimes the knife comes in handy on trees, though it is much more frequently used for opening sardine cans, paring horses' hoofs or cutting a chew of tobacco.

FIG. 38—PRUNING SAW

The pruning saw is a regular article of commerce, though the saws most widely sold for this purpose are too light and are made of very poor materials. Some pruners prefer one pattern and some another.

The hatchet and the ax should never be used for pruning fruit trees under any circumstances. The man who is guilty of this solecism should always be dropped from the horticultural club and good society generally.

Ladders are required in pruning large trees. The tree ladders, or fruit-picking ladders, are best. The peculiarity of these ladders is that they have only one point at the top instead of the usual two points. Such ladders can be bought almost anywhere of dealers in agricultural machinery or horticultural supplies, or any handy farm mechanic can make one for himself.

V

SPRAYING

By many persons, spraying is evidently regarded as the panacea for all the fruit grower's troubles. It is expected to rid the tree of every insect, to kill every fungus, to extirpate bacteria, to heal the wounds left by the whiffletrees, to repair the neglect of drainage, to offset unfavorable weather and to abate the taxes. At the very outset of this chapter we must understand, therefore, that the beneficial results of spraying are strictly limited to a few items, and that there are many troubles which cannot be reached by this means. Furthermore, spraying can be of no possible use in any case unless it be intelligently done. The work must be given at exactly the right time, certain remedies must be applied for specific diseases, and many more small details must be looked after in just the correct fashion, or the whole work will come to naught.

In broad terms, we spray for the suppression of fungous and insect attacks. The spraying for fungi is almost wholly preventive—rarely or never curative. In practical application this means that when a tree appears to be suffering from the attacks of any fungus it is already too late to do any effective spraying. It is also to be noticed that a number of serious plant diseases are caused by bacteria instead of by fungi, and that such diseases can very seldom be checked in the slightest by any kind of spraying. The deadly pear blight is of this number. Diseases which can be more or less completely prevented by

spraying are apple scab, apple tree canker, peach leaf curl and black knot of plum.

BORDEAUX MIXTURE

The standard solution for the prevention of fungous attacks is the bordeaux mixture composed of lime and copper sulphate. This is the great and

FIG. 39—SPRING CAMPAIGN AGAINST SAN JOSE SCALE

original spraying solution, and the one still most widely used. It is effective in the prevention of most preventable fungous diseases, particularly the apple scab. The standard formula is as follows:

Copper sulphate (blue vitriol)	4 pounds
Good stone lime, unslaked,	4 pounds
Water,	50 gallons

The copper sulphate should be separately dissolved. The best way to do this is to place it in a

gunny sack and hang it at the top of a vessel of water. For the quantities mentioned in the recipe above, the 4 pounds of copper sulphate should be dissolved in not more than 20 gallons of water. The lime should be slaked carefully, using only just enough water to bring it into solution. After it has been thoroughly slaked, it may be thinned out. When both solutions are thus made up, they should be diluted to 25 gallons each and poured together, being thoroughly mixed while the pouring is going on. The mixture, after being strained into the spray tank, is ready for use.

A common and excellent way of preparing this mixture for orchard use is to make up two stock solutions. The copper sulphate solution is made up by dissolving the sulphate at the rate of one pound to the gallon of water, and the lime solution similarly, with one pound of lime to the gallon of water. If, then, it is required to fill a hundred gallon tank with bordeaux mixture, it is only necessary to dip out 8 gallons of lime solution, 8 gallons of copper sulphate solution, and then mix these in the tank with enough water to make a tankful of mixture.

The formula given above is standard strength, but the mixture is often used weaker, especially on peach and plum trees. Instead of using 4 pounds of copper sulphate and 4 pounds of lime to 50 gallons of water, the diluted mixture may contain 100 or even 150 or 200 gallons of water, making the solution one-half or one-fourth strength.

It is important in making this solution to have good, clean, unslaked lime. A slight excess of lime in the solution is desirable.

The lime-sulphur spray described (page 80) as a

remedy for San José scale also has considerable fungicidal value. It is especially useful in early spring sprayings on peach trees, at which season it has measurable efficacy in preventing leaf curl.

FIG. 40—GRAVITY MIXING OF BORDEAUX MIXTURE

FIGHTING INSECTS

There are two very different types of insects which require altogether different methods of treatment for their suppression. One class takes its food by eating the leaves of the trees, the other by puncturing the bark and sucking the sap. The former insects may be killed by poisoning the foli-

age with paris green, arsenate of lead or other poisons. The sucking insects, however, cannot be poisoned by any means, and it is, therefore, necessary to spray them with some caustic or irritating substance which kills when it touches them.

PARIS GREEN

Among the poisonous sprays paris green is the best known.. It is applied after mixing 1 pound of paris green in 100 to 200 gallons of water. A pound of lime ought to be added to this mixture, however, to neutralize free arsenic, which would otherwise burn the foliage. The paris green can be added directly to the bordeaux mixture. This is a favorite way of using it.

ARSENATE OF LEAD

Probably the most popular and satisfactory poison used against chewing insects at present is arsenate of lead. This comes in various forms from the dealers—usually, however, as a paste. It is mixed at the rate of 3 pounds to a barrel of water. This has the same uses exactly as paris green, but is safer, as it does not injure the foliage. Furthermore, it has the good quality of holding on to the foliage. Arsenate of lead may be mixed with bordeaux mixture, and in fact this is the customary way of applying it.

LIME-SULPHUR WASH

This spray solution is used chiefly for killing the San José scale, and has been found on the whole the

most efficient spray for that purpose. The recipe is as follows:

Fresh stone lime,	16 pounds
Flowers of sulphur, or sulphur flour,	15 pounds
Water,	40 gallons

Flowers of sulphur usually cost a little more than the sulphur flour, but should be preferred when the solution is to be cooked over a fire in a kettle. When the solution can be cooked with live steam, which is the better way, the cheaper grades of sulphur are equally available.

FIG. 41
BOILING LIME-SULPHUR

Begin by slaking the lime in a small amount of water in a large iron kettle. When the slaking lime generates a considerable amount of heat, sprinkle the sulphur in gradually, thus utilizing the heat of the lime in cooking the sulphur. At this stage, a fire should be made under the kettle and the solution kept up to the boiling point, adding the water a little at a time. Vigorous boiling should be maintained for about an hour, at the end of which time the solution becomes a dark orange in color and should have very little sediment at the bottom. Whether it shows sediment or not, the solution

should be strained through a fine strainer into the spray tank and used while still hot.

The lime-sulphur is used also as a spring spray, especially on peach trees, for checking leaf curl. For this purpose it must be greatly diluted. It has such decided fungicidal value that it is now coming into use to some extent in treating apple trees for the prevention of scab. For summer use, on trees in

FIG. 42—THE REGULAR JOB OF SPRAYING

full foliage, the solution need not be applied hot, although it should always be used when freshly made. Even standing overnight is likely to result in considerable deterioration.

There are several forms of ready-made lime-sulphur offered on the market; some of these are fairly good, but none of them has yet been found equal to the freshly made solution described above.

SELF-BOILED LIME-SULPHUR

Another method of making the lime-sulphur spray produces what is called the self-boiled mixture, which seems to have properties considerably different from the mixture described above. This self-boiled mixture seems to be especially valuable as a fungicide, particularly on the peach. It controls the leaf-curl, the brown rot, the scab, and, when arsenate of lead is added at the spraying, after the blossoming season, the curculio also. The most recent methods of making this mixture, as worked out by Scott and Ayres of the United States Department of Agriculture, are as follows:

The 8-8-50 formula is recommended. This mixture can best be prepared in rather large quantities —say enough for 200 gallons at a time, making the formula 32 pounds of lime and 32 pounds of sulphur, to be cooked with 8 or 10 gallons of water, and then diluted to 200 gallons.

The lime should be placed in a barrel and enough water poured on almost to cover it. As soon as the lime begins to slake the sulphur should be added after first running it through a sieve to break up the lumps. The mixture should be constantly stirred and more water added as needed to form a thick paste at first, and then gradually a thin paste. The lime will supply enough heat to boil the mixture several minutes. As soon as it is well slaked, water should be added to cool the mixture and prevent further cooking. It is then ready to be strained into the spray tank, diluted and applied.

The stage at which cold water should be poured on to stop the cooking varies with different limes. Some limes are so sluggish in slaking that it is diffi-

cult to obtain enough heat from them to cook the mixture at all, while other limes become intensely hot on slaking. Care must be taken not to allow the boiling to proceed too far. If the mixture is allowed to remain hot 15 or 20 minutes after the slaking is completed, the sulphur goes into solution, combining with the lime to form sulphides, which are injurious to peach foliage. It is very

FIG. 43—TREES SPRAYED WITH LIME-SULPHUR

important, especially with hot lime, to cool the mixture quickly by adding a few buckets of water as soon as the lumps of lime have slaked down. The intense heat, violent boiling, and constant stirring result in a uniform mixture of finely divided sulphur and lime, with only a very small percentage of the sulphur in solution. The mixture should be strained to take out the coarse particles of lime, but the sul-

phur should be carefully worked through the strainer.

In using arsenate of lead with this mixture it should be added at the rate of 2 pounds to 50 gallons.

SOLUBLE OILS

There are now on the market several brands of so-called soluble or miscible oils, which are extensively used in the campaign against the San José scale. These are simply various products of the kerosene industry made up in such a manner that they mix readily with water. The usual way of applying these oils is to add one gallon of oil to 15 or 16 gallons of water, stirring the solution vigorously, usually by pumping it back into the barrel. The solution is then ready for immediate use. It is this ease of mixing and applying which forms one of the strong recommendations for this kind of spray. It gives excellent success in many instances.

KEROSENE EMULSION

For combating aphis and certain other sucking insects kerosene emulsion is always recommended, sometimes used and in rare instances proves effective. It is made up as follows:

Hard soap, shaved fine,	½ pound
Water,	1 gallon
Kerosene,	2 gallons

Dissolve the soap in the water, which should be boiling; remove from the fire and pour it into the kerosene while hot. Churn this with a spray pump till it changes to a creamy, then to a soft butter-like

mass. Keep this as a stock, and use one part in nine of water for soft-bodied insects such as plant lice.

DUST SPRAYING

Fungicides and insecticides are sometimes applied as a dry powder instead of as a liquid spray. In this case a special blower is used in place of the regulation pump. The dust method of spraying, however, is generally regarded as the lazy man's makeshift, and is not to be adopted where the ordinary methods are available. The dust spray has been found most useful where water for making solutions is very scarce, or on certain very rough and rocky lands where the barrel pump could not be carried. Thus, it has happened to be more at home in the Missouri Ozarks than elsewhere. The following directions are adopted bodily from Missouri:

TO MAKE 70 POUNDS OF STOCK POWDER

4 pounds copper sulphate
4 pounds quicklime
2½ gallons water in which to dissolve copper sulphate
2½ gallons water in which to slake quicklime
60 pounds air slaked lime thoroughly sifted

Dissolve the copper sulphate and slake quicklime separately, each in 2½ gallons water. Pour at same time milk of lime and copper solution into a third vessel and stir thoroughly. Surplus water is then strained out and remaining wet material is thoroughly mixed with the 60 pounds of air-slaked lime.

All lumps must be sifted out and the mixture must be perfectly dry. One pound each of sulphur and paris green may be added.

SPRAY MACHINERY

A spraying outfit consists essentially of four parts: (1) a tank or a barrel with some means of carrying it, (2) a pump, (3) a suitable length of

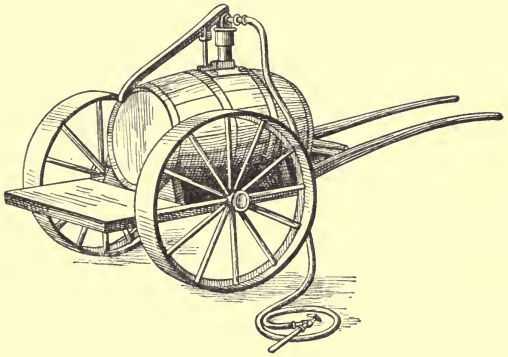

FIG. 44—CONVENIENT CART OUTFIT

hose, and (4) a nozzle or nozzles. These various elements are all of them important. They should be fully understood by the operator, should be carefully selected in buying, and should be kept up to their original efficiency by good care and frequent inspection.

The tank or the barrel is perhaps the easiest part to provide to one's satisfaction. Any sound kerosene or whiskey barrel may be used, or a good bar-

rel bought of the dealers in spray machinery. For large operations a 200-gallon tank will be needed. This can best be bought direct from the dealers.

FIG. 45—SUBMERGED BARREL PUMP

The pump is the vital part of the spray outfit. It must be strong and easy working, and all the working parts must be of brass. An ordinary iron pump is quickly ruined by the corrosive liquids used in spraying. The submerged hand pumps are best for ordinary work, the double-acting pump (see Figure 46) for heavier hand spraying, while the heavy double-acting pumps go with the kerosene power sprayers.

The hose should be specially selected for spraying and should be the best rubber hose, ¼ inch in diameter. Some operators, however, prefer cheap cotton hose ½ inch in diameter.

The nozzle is of great importance. While there

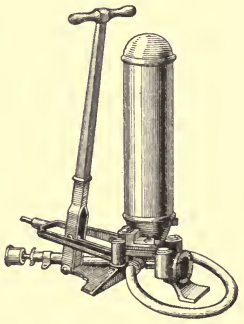

FIG. 46—LARGE HAND PUMP

are a great many different makes on the market, most of them conform to two general types, the bordeaux and the vermorel (see Figures 47–49). It may be pointed out that of these two types of nozzle the vermorel gives the finer spray, while the bordeaux throws to the greater height. The vermorel nozzle should be used by preference wherever the work can be readily reached, as the fine misty spray is much more effective in coating the leaves, while it is at the same time more economical of the solution. When the tops of large trees have to be reached, however, it is necessary to use a nozzle with more squirt to it. A good practical arrangement consists in having two leads of hose on the spray pump, one fitted with vermorel nozzles, the other with the bordeaux. Then the man who handles the bordeaux nozzles will do the work in the tree tops while his co-workman with the vermorel nozzles gives his attention to the lower branches.

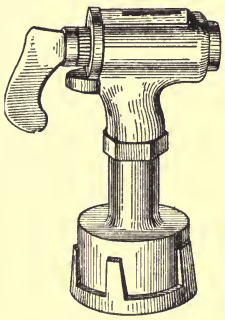

FIG. 47—NOZZLE OF BORDEAUX TYPE

Spraying outfits as a whole may be conveniently classified into three types, the knapsack sprayer, the barrel sprayer and the power sprayer. Of these the knapsack sprayer is not much used nowadays. Even for small gardens it is unsatisfactory, the small barrel pumps being as cheap and much more efficient.

The barrel outfit (see Figure 45) is the equipment proper for most gardens and small orchards. The barrel may be bought ready mounted on a special truck or carriage; but as a rule the barrel can best be purchased separately and carried about the place in any common wagon.

The large power outfits are very valuable for heavy work in large orchards. They are by no means suited to the accomplishments of the beginner, and so the reader of this book may properly be referred to more professional sources for suggestions on this topic.

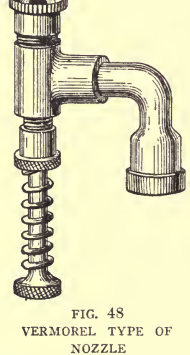

FIG. 48
VERMOREL TYPE OF NOZZLE

THE SPRAYING CAMPAIGN

In order to get the best results from spraying it is necessary to have a definite program of operations. A single isolated spraying given for some specific purpose may pay its way, but it cuts a small and sorry figure in the general practice of modern fruit growing. The general program of work will usually be outlined somewhat as follows:

1. *Midwinter to March 15.*—A thorough application of lime sulphur or soluble oil for San José scale. Of course, in any orchard where San José scale does not exist, this treatment may be omitted. In orchards where it does exist annual treatment is usually necessary, the complete annihilation of these insects being of so rare occurrence as hardly to need mention. It is the practice of many good fruit

growers to use lime-sulphur spray one year and soluble oil the next. In other cases where the lime-sulphur is depended upon for its fungicidal properties, growers prefer to use it every year rather than to alternate with soluble oil.

2. *An early spring treatment with fungicide.*—On apple, pear and plum trees, this usually means a thorough drenching with plain solution of copper sulphate, 5 pounds to 50 gallons of water applied before the buds start. The lime sulphur spray has been found decidedly better for peach trees, and in fact this spray is coming into use on other fruit also. The purpose of this early spring spraying is to kill the fungus spores adhering to the trees. In many orchards this is the most valuable spraying of the year.

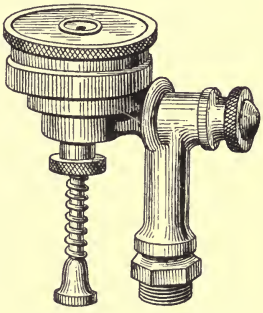

FIG. 49—NOZZLE OF IMPROVED VERMOREL TYPE

3. In orchards where a special fight is to be made against fungi, particularly apple and pear scab, another spraying is given immediately before the blossoms open. In nearly all cases this treatment will be made with plain bordeaux mixture.

4. As soon as the blossoms have fallen from the trees, operations should be begun for what is actually, in ordinary practice, the big treatment of the year's campaign. At this time the trees should be treated with bordeaux mixture combined with some

insect poison, preferably arsenate of lead. Bordeaux mixture protects the newly formed leaves from the attacks and fungi, while the poison protects the newly formed apples, pears or quinces from the attacks of the codling moth and the foliage from the incursions of leaf-eating insects. Under no circumstances should the spraying be done while the fruit trees are in blossom. It may injure the fruit blossoms, and it is almost sure to poison the bees, which are one of the fruit grower's best friends.

5. About two weeks later another spraying is due, this time with bordeaux mixture and poison, or with weak lime-sulphur and poison.

6. Additional sprayings are usually recommended up to the middle of July or the first of August, to be given at intervals of 10 days to two weeks. There are very few fruit growers, however, who carry out this complete program, omissions commonly being made from the foot of this list. Careful experiments and wide experience have both shown, however, that four, five and six sprayings may be usually given at a profit. Each successive spraying will show a sufficient gain over the previous ones to pay its cost and leave something for the fruit grower.

Such an outline as that here given can be only suggestive, of course. Improvements in spray solutions and spraying methods are being made rapidly year by year, and local conditions of climate often require important adjustments. Those who are inexperienced in spraying operations and who cannot easily come by the personal help of some one who knows, had better get the latest spray bulletin from their state experiment station before beginning. Such bulletins are issued in most states, and

have the merit of conveying the latest information and of suggesting the necessary local adjustments of practice.

In this connection, speaking both of bulletins and of the spraying campaign, we may reproduce by way of illustration the excellent program arranged by Prof. S. A. Beach for use in Iowa.

SPRAYING CAMPAIGN

WHEN TO SPRAY	WHAT TO SPRAY FOR
1. When the green tips of the first leaves get as large as mouse ears.	Apple scab, canker and leaf spot, bud moths, canker-worms, case bearers, tent caterpillars, and other leaf-eating insects. Where apple scab and insects have not been abundant or where the trees have been sprayed during the dormant season, treatment at this time may be omitted.
2. Just before the blossoms open.	Apple scab, canker and leaf spot. Curculio, and all insects mentioned in 1. *The most important single treatment against the scab.*
3. Just as the last of the apple blossoms are falling.	Apple scab and other diseases. Codling moth, curculio and insects mentioned in 1. *The most important single spray against the codling moth.*
4. From 10 to 20 days later than 3.	Apple scab, bitter rot and other diseases. Insects as mentioned in 3. Where bitter rot and blotch are troublesome, bordeaux is recommended rather than lime-sulphur.
5. In late July or early August, or about 10 weeks later than 4.	Bitter rot, scab and other diseases. Codling moth and other insects. Very important in fighting second brood codling moth.

SPRAYING CAMPAIGN—*Continued*

WHEN TO SPRAY	WHAT TO SPRAY FOR
6. From 10 to 20 days after 5.	Where second brood codling moth is very numerous, arsenate of lead should be used at this time. If bitter rot and blotch are abundant, use bordeaux mixture also.

IMPORTANT SUGGESTIONS

Paris green, arsenate of lead and some other spray materials are poisons. Treat them as such. Keep them locked up out of the reach of stock, poultry and especially children.

Spray intelligently. Be sure of the disease, actual or threatened, of the remedy and the method of application.

Spray every year. This is of the utmost importance. The benefits of spraying last for several years. So do the results of neglect.

Never spray when the fruit trees are in blossom. It does no good, it may do harm to the blossoms, and it is almost sure to poison bees.

Use fresh solutions wherever possible and always strain them into the tank.

Do not spray immediately after a shower. Much of the solution will run off.

In general, make the finest spray possible—a mere mist. Spraying does not take the place of irrigation. It is not even the intention to give the tree a bath.

But spray all over the tree, trunk, branches and bottoms of the leaves. Thoroughness is one of the most important points.

Clean pump and nozzles thoroughly when through.

Give plenty of pressure on the pump. Hard pumping with a good pump is what makes the fine spray. A pressure gauge on the pump should show 60-100 pounds to the square inch.

Get the latest spray bulletin from the state experiment station and follow the directions as well as you can. When in doubt, ask advice. It costs nothing and, as Huckleberry Finn said, it is often worth it.

VI

THE VARIOUS FRUITS

The apple is easily the king of fruits. It is grown more widely than any other, there are more varieties, it covers a longer season, and it is used in a greater variety of ways. It is the fruit most extensively cultivated for market.*

In the selection of varieties for planting very careful attention should be given to questions of local adaptation—questions which have been sadly overlooked in recent years in America. Too much attention is paid to universal favorites, like Baldwin and Ben Davis, and not enough to those which succeed splendidly only in restricted neighborhoods, like Roman Stem, Jeffris and Palmer Greening. Moreover, in planting a home garden the principles of selection should be altogether different from those governing the choice of varieties for a commercial orchard. This distinction is often lost to sight, though at many points the commercial requirements are directly opposed to the demands of the family orchard. In order to bring out and emphasize this difference it will be well to contrast these principles of choice in the following table:

*The bulk of recent American literature on apple growing deals with commercial culture. Those interested in this line should read *The American Apple Orchard* by F. A. Waugh, and *American Fruit Culturist* by John J. Thomas. The present work deals more with amateur fruit growing and presents the matter in a more elementary form.

RULES FOR CHOOSING VARIETIES

COMMERCIAL ORCHARDS	HOME ORCHARDS
Select a very few varieties.	Select many varieties.
Choose standard market sorts	Choose family favorites.
Give only second thought to quality	Put quality first.
Prefer late-keeping winter varieties (the old rule, subject to exceptions).	Provide a succession of varieties.
Choose only hardy, healthy sorts.	Stick to some good varieties in spite of defects of tree.
Plant no novelties or oddities.	Test occasional promising novelties, and grow some sweet apples, crabs, etc.

Having laid it down as a general principle that a long list of varieties may be grown in the home orchard, and that personal preference should largely influence the choice, we have made it exceedingly difficult to offer a recommended list of varieties. But as such lists seem to be expected in every work of this character, the following suggestions are offered for the use of the beginner who has no better advice to draw upon:

For Central New England, New York state and southern Michigan: Benoni, Chenango, Early Harvest, Garden Royal, Jeffris, Maiden Blush, Porter, Red Astrachan, Williams Favorite, Yellow Transparent, Fall Pippin, Gravenstein, Mother, Duchess of Oldenburg, King, Wealthy, McIntosh, Rhode Island Greening, Bailey Sweet, Isham Sweet, Baldwin, Hubbardston, Westfield Seek-no-further, Wagener, Sutton.

In northern New England: Northern Spy, Fameuse, Livland Raspberry and other hardier

FIG. 50—HARVESTING THE PEACH CROP

varieties should be considered. In southern New England: Grimes Golden, Jonathan and Newtown Pippin may be successfully grown.

In New Jersey, Delaware, Pennsylvania and the higher altitudes of Maryland, Virginia and West Virginia: Early Harvest, Porter, Golden Sweet, Red Astrachan, Williams Favorite, Yellow Transparent, Primate, Maiden Blush, Rambo, Fall Wine, Wealthy, McIntosh, Grimes, Peck Pleasant, Tolman Sweet, Hubbardston, Nero, Stayman, Winesap, Newtown (or Albemarle) Pippin, Jonathan, York Imperial.

For Ohio, Indiana, Illinois, Missouri, Kentucky and Tennessee: Red June, Red Astrachan, Yellow Transparent, Duchess of Oldenburg, Chenango, Benoni, Early Joe, Sweet Bough, Early Harvest, Maiden Blush, Wealthy, Grimes, Bailey Sweet, Jonathan, Ralls, Roman Stem, Winesap, Stayman, Newtown Pippin, Yates, Ben Davis.

For the South Atlantic states: Early Harvest, Sweet Bough, Red June, Chenango, Early Joe, Jeffris, Maiden Blush, Red Astrachan, Horse, Summer Rose, White Juneating, Grimes, Jonathan, Langford, Shockley, Stayman, Romanite, Yates.

For Wisconsin, Minnesota, South Dakota and Iowa: Charlamoff, Longfield, Livland Raspberry, Duchess of Oldenburg, Switzer, Hibernal, Northwestern Greening, St. Lawrence, Wealthy, Malinda, Milwaukee, Patten.

For Nebraska, Kansas, Colorado and Oklahoma: Yellow Transparent, Red June, Benoni, Chenango, Maiden Blush, Duchess of Oldenburg, Early Joe, Dyer, McIntosh, Wealthy, Grimes, Roman Stem, Rambo, Jonathan, Ben Davis, Winesap, Stayman, White Winter Pearmain.

For the Pacific Coast region: Early Harvest, Yellow Transparent, Red Astrachan, Benoni, Golden Sweet, Gravenstein, Fall Pippin, Fameuse, McIntosh, Rambo, Baldwin, Esopus Spitzenburg, Newtown Pippin, Rome Beauty, Jonathan, Yellow Belleflower, Grimes.

Crab apples are well worth including in every

FIG. 51—EDGE OF THE HALE CONNECTICUT ORCHARDS

garden of any extent. The varieties almost universally preferred are Hyslop and Transcendent.

PEACHES

The list of valuable peaches is much shorter than the apple list, and the local adaptations are much less important. Elberta is the hardiest and most prolific yellow peach, but is not of so good quality as Foster, Early Crawford or Late Crawford. White peaches of the modern type (Chinese Cling group)

are very different from the old-fashioned white peaches, and represent the acme in peach quality. Of these Greensboro, Hiley, Waddell, Champion, Carman and Belle of Georgia offer a splendid selection. These varieties have the further important advantage of withstanding the cold of winter and the late frosts of spring better than almost any other known sorts.

Other well-known varieties, favorites with some growers, are Alexander (very early), Chairs (yellow midseason), Fitzgerald (extra hardy), Mamie Ross (early, good quality), Mountain Rose (midseason, white, good), Oldmixon (medium late, good quality), St. John (yellow, fair).

PEARS*

As a rule pears do not succeed well in North America. There are some local exceptions to this statement, but in general pears of any sort are a rarity. The varieties most commonly successful are Bartlett, Seckel, Bosc, Anjou, Flemish Beauty, Lawrence, Sheldon and Winter Nelis. In the central and south central states Kieffer is grown much more extensively than any other variety. It is hardy and prolific, but very poor in quality except for canning. Other varieties which are worth planting in sections where pear culture amounts to anything are Angouleme, Buffum, Clairgeau, Comice, Dana's Hovey, Louise Bonne de Jersey, Vicar of Winkfield.

Pears prefer a rather heavy soil. They should also receive less cultivation and less nitrogenous

*For a more extended discussion of pears and pear growing see *Pear Culture for Profit*, by P. T. Quinn.

fertilizer than apples. Any treatment which serves to force them into vigorous growth invites the attacks of pear blight. About the only practical treatment for this blight is to cut out and burn the blighted branches.

FIG. 52—PROFITABLE DWARF PEARS IN WESTERN NEW YORK

PLUMS*

So many different varieties and species of plums are in cultivation in America that it is hard to make

*Those who wish to pay particular attention to the cultivation of plums should consult Waugh's *Plums and Plum Culture*, published by Orange Judd Co., New York.

any recommendations in a general work like the present. The principal groups of varieties are as follows:

The European plums, derived from the botanical species, *Prunus domestica,* and numbering such diverse varieties as Green Gage, Fellemberg, Lombard, Coe's Golden Drop, Magnum Bonum or Yellow Egg, and many others of considerable value. These are grown successfully on the Pacific coast, where many of them are known as prunes, and in Michigan, New York and New England. Elsewhere they are generally a highly qualified success.

The Damsons. These are small, mostly blue plums, very sour. They are hardy and prolific, and many housewives have a great predilection for them in the making of preserves. There is usually a good demand for them in the market. They succeed in the same territory as the European plums mentioned above, but may be grown fairly well also in Wisconsin, Iowa, Nebraska, Kansas, Missouri, Illinois, and Indiana. The best varieties are Shropshire, Cluster and French Damson.

The Japanese plums have become very popular, especially in the eastern, central and southern states. They come quickly into bearing, are very prolific and are not generally subject to serious diseases. The best varieties are Red June (on account of its earliness rather than for quality), Abundance, Burbank, and Satsuma (with red flesh).

Native plums of several different species are worth cultivating in the garden, especially in the Gulf and Mississippi Valley states. In these sections the nurserymen propagate for sale many excellent varieties, of which the best known are Wild-

FIG. 52. GOOD ROW OF BUDDED PLUMS

goose, Milton, Newman, DeSoto, Hawkeye, Surprise, Weaver.

Hybrid plums of many different varieties have been introduced of late years, some of which are decidedly promising, especially for use in southern central states. As a mere suggestion, we may name Gonzales, Excelsior, Golden, and Wickson.

CHERRIES

The cherries may be separated into two broad groups, the sweet cherries and the sour varieties. The former varieties are comparatively difficult of cultivation and succeed only in restricted localities in New York state, neighboring states and on the Pacific coast. The sour cherries on the other hand are very hardy and thrive throughout the northern states very generally.

The favorite sweet cherries are Black Heart, Downer, Elton, Napoleon, Oxheart, Yellow Spanish, Black Tartarian, Windsor and Governor Wood.

The best sour cherries are Montmorency, May Duke, Morello, Richmond and certain Russian sorts of rather uncertain nomenclature.

APRICOTS

In California the apricot succeeds admirably. The tree grows well in most of the northern and central states, but is very uncertain in fruiting. Nowhere can it be called satisfactory, much less indispensable. The best-known varieties are Alexander, Blenheim, Early Golden, Harris, Moorpark.

NECTARINES

The nectarine strongly resembles the peach, the

FIG. 54—EARLY RICHMOND CHERRY IN BLOOM

characteristic feature being that the fruit of the nectarine is smooth like a plum instead of being covered with a fuzz like the peach. Nectarines are rather widely grown in Europe and deserve more attention in America. They may be propagated and cultivated exactly like peaches. Leading varieties are Downton and Early Violet.

FIG. 55—APRICOTS GROWN IN MASSACHUSETTS

QUINCES*

The quince is of easy cultivation, thriving in almost any soil and climate adapted to the apple. The leading varieties are Champion, Orange, Rea and Bourgeat.

*The only special work on this fruit is *Quince Culture* by W. W. Meech.

FIG. 56—RENOVATION PRUNING IN PROGRESS

VII

RENOVATION

The problem which the beginner in fruit growing has to face is not always that of planting a young orchard. Indeed, when one is seeking out a piece of land with a view to embarking upon the fascinating field of pomology, he nearly always prefers to select a farm which already has some apple trees on it. Nine times out of ten these are old trees and in a certain stage of neglect and disrepair. The renovation of these old orchards is a rather common practice and probably always will be. It is interesting and in some cases profitable.

IS IT WORTH WHILE?

The question whether it is to be profitable or not can be answered with some reasonable certainty in advance. The answer will depend upon the condition of the trees and upon the methods adopted for their recovery. As regards the condition of the trees, there are four things to be noticed in particular. These are: (1) the age and kind of the trees, (2) the stand, (3) varieties, (4) scale, canker and other diseases.

If the trees are very old and decrepit, there is, of course, no use in trying to rejuvenate them. As a rule, trees more than 50 years old are likely to be beyond profitable recovery, though this age limit varies widely. If the trees have several sound limbs and are making 2 or 3 inches growth each

year, they may be considered in sufficiently good condition for treatment. On the other hand, if the tops are mostly dead, if there are heavy limbs broken down, and if there are large rotten cavities,

FIG. 57—OLD TREE BEFORE RENOVATION

the trees will probably cost more than they are worth before they can be brought back to useful lives.

The stand of trees should be fairly uniform and complete. If the orchard has been depleted by any

cause until there are less than 20 trees to the acre, it may be considered doubtful expediency to attempt a renovation. This will depend naturally more or less upon the value of the land. Cheap or waste land might be left to support 10 or 15 trees

FIG. 58—SAME TREE FIRST SUMMER AFTER TREATMENT

to the acre, but good land which can be brought under cultivation had better be restored to the plow by complete clearing unless it can show at least a half a stand of trees.

The varieties should be worth while. It is only a waste of money to save a tree which will bear

nothing but worthless fruit after it has been renovated. Of course, any healthy tree, no matter how worthless the fruit is ordinarily, may be grafted to

FIG. 59—SAME TREE AFTER TWO YEARS—RETOPPED

any desirable variety, and this regrafting of undesirable tops to better varieties is often an important item in the whole program of renovation. At the same time this grafting is hard work and pre-

sents some risks and difficulties, so that the orchard must otherwise be much better in order to justify the undertaking.

It is important also to observe the extent to which an orchard is attacked by insects and diseases. The most important of these enemies and the ones most commonly found in neglected orchards are San José scale, oyster shell louse and apple tree canker. All of these can be overcome, but to get rid of them requires labor and expense. Therefore, they offer an objection to undertaking the renovation of any orchard, and in case of doubt may turn the decision against the attempt.

HOW THE WORK IS DONE

The work of renovating an old orchard consists in a series of operations which must all be brought together in effective array in order to secure success. The most important of these operations, named approximately in the order in which they are undertaken, are (1) pruning, (2) scraping, (3) grafting, (4) spraying, (5) plowing, (6) fertilization, (7) cover cropping, (8) systematic good management. Let us look at these in more detail.

In most cases the renovation of an old orchard begins with pruning. This pruning is commonly done in early spring, viz., between February 15 and April 15. It would be a decided advantage if a considerable portion of this pruning were undertaken in June or July. In any case it will be best to carry out the work in two or three installments. At the first pruning only the largest broken limbs are to be removed, along with the wood which is actually dead. After them there may be taken out

interfering branches and those which render the tree unsymmetrical.

On most old trees an important part of the pruning consists in shortening in the heads. In order to get nearer to the base of operations, and especially to bring the tree down within the range of the spraying machine, fairly extensive heading-in is often necessary. This part of the work in particular should be accomplished with care and circumspection, and should be distributed over two or three years if possible.

At the first attack upon the problem the trunk and main branches of the trees should be scraped

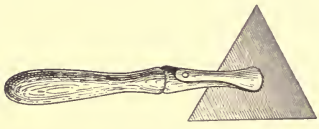

FIG. 60—TREE SCRAPER

clean. This work is done with a dull knife or an old hoe or with a special tree scraper, which may be bought from any dealer for 25 or 30 cents. The removal of the old broken bark, all of which should be put on the bonfire and burned, gets rid of a large storehouse of fungus spores. This old bark is the favorite lodging place of all kinds of orchard pests. When it is removed such insects and fungi are not only killed in the process, but their hiding place is removed for the future.

If the trees are to be regrafted to new varieties this work will accompany the original spring pruning and scraping. The work should be done in early spring, as already described on page 12. Many

practical fruit men consider it an advantage to distribute this part of the work over two or three years rather than to do it all at once. As the grafting itself requires the removal of a certain number of branches, it should be done before the pruning in order that the graftsman may intelligently choose the positions for his grafts.

FIG. 61—OLD TREE MODERATELY HEADED BACK

Oyster-shell louse and San José scale should also be attacked at the time the campaign is opened. They should receive thorough spraying early during the first spring. Probably the best all-round treatment for these insects will be the thorough application of lime-sulphur wash, which should be

put on as warm as possible. Canker will be taken care of more effectively by the spring applications of bordeaux mixture which are to follow.

CULTIVATION

Practically all neglected orchards stand in sod land and in practically all cases one of the first and most important steps in their conversion to a useful life consists in plowing the soil. This is an undertaking for a man of patient and forbearing temper. The renovator should also have a quiet and steady team. A well-trained team of oxen is particularly useful in this sort of salvage. A strictly fancy job of plowing must not be expected at this time. While the plow need not go down very deep, it should go as deep as the strength of the oxen and the driver's Christian principles will justify. Inevitably a number of large tree roots will be encountered. In some cases the plowman may cut his way through these with an ax; and unless a large amount of this chopping is done near the main trunks of the trees no damage whatever will result. In fact, this sort of root pruning, within moderate limits, must be considered a direct advantage in the line of the main undertaking.

FERTILIZERS

All neglected orchards are suffering for want of plant food and their recovery will require the adoption of a rational system of fertilization. At the beginning the amounts of fertilizers applied should be relatively small, however. In fact, upon good land it may be a question whether it is not better

to omit all fertilizers during the first two years of the renovation work. The stirring of the soil will liberate additional plant food and the pruning of the trees will itself start up an unusual amount of growth. If large amounts of fertilizers are added at the same time, especially barnyard manure or other forms of nitrogen, the trees may easily be forced into a too vigorous growth. Still, some fer-

FIG. 62—A BALDWIN ORCHARD SUCCESSFULLY RENOVATED

tilizers will be required. The plan of feeding this plant food to the trees should be mapped out on the basis of the needs of a full-grown orchard and the trees should be brought up gradually to this allowance.

The cover cropping will follow in the routine of orchard management, as already described on page 43. The cover crop will be especially valuable in bringing the soil into a good physical condition and in adding the supply of humus which is apt to be

deficient in neglected orchards. Buckwheat is probably one of the very best crops for use under these circumstances.

General good management must replace general neglect all along the line in accomplishing what we have here in view. This will mean cultivation of the soil throughout the summer, and a regular campaign of spring and summer spraying. In fact, this is the essence of the whole method; namely, that all these various lines of work shall be applied at once and in organized co-operation. Attempts at renovating old orchards often fail, but the reason is that some one has a notion that the whole thing can be accomplished by grafting or by spraying, or by some other one or two partial reforms. In most cases it is not worth while to undertake any one of these unless the whole scheme is to be put through vigorously and systematically to the end.

When such a campaign is intelligently carried out, however, upon trees which have a reasonable hope of life, the results are often surprisingly good. Hundreds of cases are known where such old orchards have been brought to a highly profitable condition. This usually requires two to five years. Commonly the results begin to show in a small crop of fruit the second or the third year. From that time forward the crop should increase in quantity and improve in quality.

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